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PROGRAM FOR THE MANAGEMENT OF HAZARDOUS WASTES

VOLUME 2

BATTELLE MEMORIAL INSTITUTE

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The report contains data, analysis, and rationale that define and identify hazardous waste streams according to industry classification and by hazardous constituents. A priority ranking system is proposed which may be employed to develop a priority-of-concern list of hazardous wastes. Site-types are identified; process selection and design concepts are described and include system flow diagrams and various sub-systems (e.g. liquids-solids separation module, resource recovery, and effluent monitoring); issues of transportation of hazardous wastes are described; and detailed cost estimates for "small", "medium", and "large" site-types are developed.

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Volume Two of Two Volumes

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1974

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APPENDIX A

INTERIM ESTIMATION PROCEDURES FOR OPERATION OF THE WASTE STREAM MODEL

The following techniques are recommended as interim procedures for determining hazard parameters of waste streams based upon their chemical makeup. These can be employed for use in the decision model until waste stream data is available.

RADIOACTIVITY

The radioactive screen is unchanged by the need for additive estimation. The test remains a determination of whether any constituent exceeds permissible discharge levels.

BIOCONCENTRATION

The bioconcentration screen is a difficult one to operate with the additive estimation. The best approximation, however, is to check that no bioaccumulative constituent exceeds the permissible level for U.S. surface waters as designated by the Federal Water Quality Administration.[A-1] Where data exists on excretion rates, this requirement can be relaxed to allow discharge of wastes containing bioaccumulative constituents at concentrations below accepted excretion rates for food chain organisms.

FLAMMABILITY

Additive estimations for the flammability screen will be judgmental in that it will be necessary to determine whether (1) constituents in the waste stream have been designated Category 4, and (2) the remaining constituents in the waste are liable to affect the flammability characteristics of the Category 4 constituents. Such judgments should be relatively easy to perform and are not considered highly subjective.

REACTIVITY

Additive estimations for reactivity will be similar to those for flammability. Category 4 constituents can be identified in waste streams, and judgments will be made as to the effect of the other constituents on the reactivity of the Category 4 compounds. Reactivity determinations will be somewhat more complicated than flammability considerations due to potential binary interactions which can release sensitive by-products or lower initiation thresholds. The National Academy of Sciences has been exploring some of these interactions from the standpoint of cargo compatability in barge transportation.[A-2]

ORAL TOXICITY

Additive estimations of oral toxicity levels for waste streams can be calculated by use of Finney's mathematical model for additive joint toxicity.[A-3] This formulation predicts the composite LD_{50} to be equal to the inverse of the sum of the proportion of each constituent divided by its characteristic LD_{50} value:

$$1/LD_{50}\ \text{waste} = \sum_{x=1}^{a} Px/LD_{50x}$$

where Px is the fraction of constituent x in the mixture. Clearly, LD_{50} data is not always additive. In many cases, however, it can be. Smyth, *et al*. found the LD_{50} values for combined organic solvents were generally quite close to predicted values.[A-4] With materials that have distinctly different toxic effects and hence are not additive, the estimated value should serve as a maximum limit unless synergism comes into play. Only work with the actual waste stream can shed light on these problems. Until that data is available, the additive assumption should suffice.

INHALATION TOXICITY

The additive estimate for an LC_{50} can be determined in much the same way as the waste LD_{50} value. The predicted LC_{50} is found from the formula:

$$1/LC_{50}\ \text{waste} = \sum_{x=1}^{a} Px/LC_{50x}$$

The same reservations on the additivity of oral toxic action applies for inhalation toxicity.

DERMAL PENETRATION TOXICITY

The additive estimation for dermal LD_{50} values can also be made using the joint toxicity model:

$$1/LD_{50}\ \text{waste} = \sum_{x=1}^{a} Px/LD_{50a}$$

DERMAL IRRITATION

The additive estimate for dermal irritation will require judgmental decision just as the flammability and reactivity estimates do.

If a waste contains constituents with an irritation of Grade 8 or greater by the Smyth or FDA methods, it must be further reviewed. In terms of simple dilution this can be done quite easily. A 10 percent solution of Grade 10 material will have a Grade 9 rating. Similarly a 1 percent solution of Grade 10 material will have a Grade 8 rating. When additional constituents are included the issue becomes clouded. Some materials may be additive in irritational effect, but many will show no interaction or even antagonism. These must be reviewed as individual cases to determine if the Grade 8, 9 or 10 constituents are dilute enough to no longer produce necrosis in a 1 percent solution or if FDA ratings are likely to change markedly. In general, constituents with similar chemical structures may be treated as additive. For example, phenolics have been shown to have additive effects.[A-5] One guideline which may also be used is waste stream pH. Surface water intended for body contact should be limited to the pH range 6.5 - 8.3. Applying the 100 to 1 dilution assumed in the dermal irritation screen, pure acid or basic wastes below pH 4.5 or above 10.3 should be considered hazardous on the basis of dermal irritation. Waste buffer capacity will complicate this calculation.

While this interim additive approach leaves room for subjective judgment in estimating dermal irritation ratings for complex organic mixtures, waste stream data can readily be developed using the prescribed testing techniques. Results of this testing will eliminate the need for judgmental decisions.

AQUATIC TOXICITY

The additive estimate for a waste's aquatic toxicity can be made in the same way as for the LD_{50} using the joint toxicity model:

$$1/\mathrm{TLm\ waste} = \sum_{x=1}^{a} \mathrm{Px}/\mathrm{TLmx}$$

Once again, the additive assumption will not always be appropriate, but it has been found to be reliable for phenolics, some metals, and certain related organic compounds.[A-6]

PHYTOTOXICITY

The additive estimate for phytotoxicity can be derived in the same way as that for aquatic toxicity using the joint toxicity model:

$$1/\mathrm{Il}_{50}\ \mathrm{waste} = \sum_{x=1}^{a} \mathrm{Px}/\mathrm{Il}_{50x}$$

The assumption that all constituents will have additive effects is again a gross one, but for phytotoxicity it should represent a maximum possible level. Once again, data on actual waste streams will eliminate the uncertainty.

GENETIC ACTIVITY

Because of the complexities of determining genetic effect potential, the additive estimation technique for this screen must be highly judgmental. All wastes containing known carcinogens, mutagens, and teratogens should be reviewed carefully. Of importance will be not only the concentration of those constituents in the waste but the physical nature of the wastes as well. Carcinogenic action generally results from contact or inhalation. Arsenic is the single example of a potential carcinogen known to act on man through consumption in water.[A-7] Teratogens on the other hand are generally received via ingestion. Mutagens have never been correlated with an impact on man and no single case of mutagenesis in man has ever been reported.[A-8] Hence, a judgment must be made as to whether any genetic agents identified or thought to be present in a waste do in fact present a hazard.

It must be re-emphasized that the additive estimation technique has been developed as an interim solution pending collection of hazard data on the waste streams themselves. There is no existing methodology for accurate assessment of the hazard potential of complex wastes short of physically testing the wastes. Hopefully, however, the additive estimate system presented here will supply sufficiently accurate data to allow for preliminary classification of wastes.

APPENDIX B

USE OF THE DATA SHEETS

During the course of the work described herein, data was gathered on existing waste streams to assist in the assessment of the quantity and nature of hazardous wastes generated in the United States. Appendices C-F contain work sheets employed during the data collection activities. Figure A-1 contains a legend for reading the data sheets and Table A-1 identifies the states associated with each Bureau of Census region referred to in the geographical distribution section.

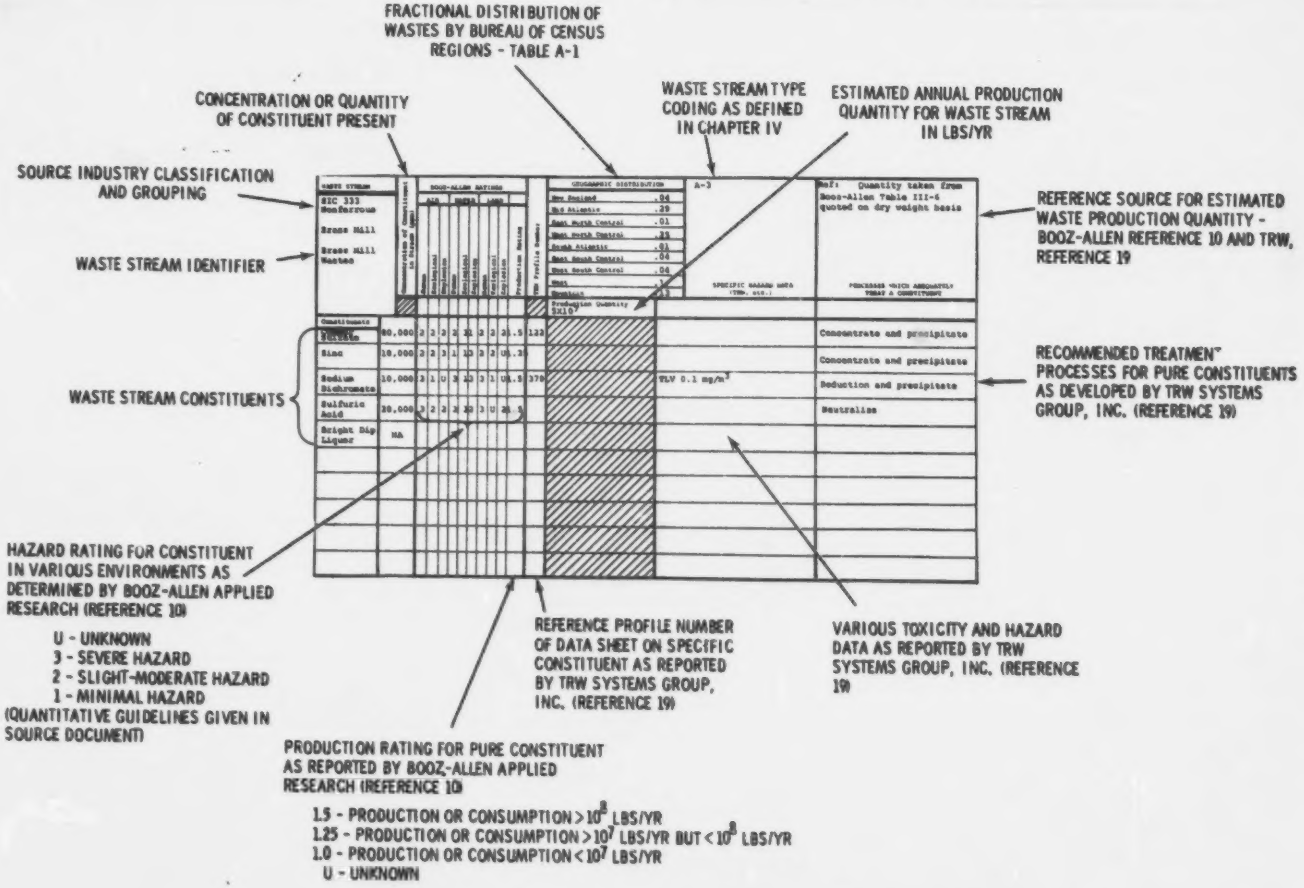
It is emphasized that these data sheets were working documents designed for the purposes of the reported study. They do not contain all known data on the subject waste streams. They principally contain data presented by TRW Systems Group, Inc. and Booz-Allen Applied Research in prior programs (References 19 and 10, respectively in Chapter III) and refer to typical values for the industry of interest. Waste streams from a specific plant may differ considerably due to variations in production techniques and ancillary activity.

Waste streams identified were characterized prior to any treatment. Hence, many of these streams may receive sufficient treatment on site to eliminate the necessity of slipping them to a national disposal site. The existing data base must be improved to clarify the present status of these wastes and to provide more detailed information than that presented here.

The data sheets are dividied into appendices according to their qualification as hazardous or nonhazardous wastes under the pure compound approach and/or the waste stream decision model. Within each appendix the waste streams are ordered by ascending SIC number. No SIC numbers were attributed to radioactive waste streams or blowdown from cooling towers.

FIGURE A-1

LEGEND FOR INTERPRETATION OF APPENDICES C-F


FRACTIONAL DISTRIBUTION OF WASTES BY BUREAU OF CENSUS REGIONS - TABLE A-1
CONCENTRATION OR QUANTITY OF CONSTITUENT PRESENT
WASTE STREAM TYPE CODING AS DEFINED IN CHAPTER IV
ESTIMATED ANNUAL PRODUCTION QUANTITY FOR WASTE STREAM IN LBS/YR
SOURCE INDUSTRY CLASSIFICATION AND GROUPING
WASTE STREAM IDENTIFIER
REFERENCE SOURCE FOR ESTIMATED WASTE PRODUCTION QUANTITY - BOOZ-ALLEN REFERENCE 10 AND TRW, REFERENCE 19
WASTE STREAM CONSTITUENTS
RECOMMENDED TREATMENT PROCESSES FOR PURE CONSTITUENTS AS DEVELOPED BY TRW SYSTEMS GROUP, INC. (REFERENCE 19)
HAZARD RATING FOR CONSTITUENT IN VARIOUS ENVIRONMENTS AS DETERMINED BY BOOZ-ALLEN APPLIED RESEARCH (REFERENCE 10)
U - UNKNOWN
3 - SEVERE HAZARD
2 - SLIGHT-MODERATE HAZARD
1 - MINIMAL HAZARD
(QUANTITATIVE GUIDELINES GIVEN IN SOURCE DOCUMENT)
REFERENCE PROFILE NUMBER OF DATA SHEET ON SPECIFIC CONSTITUENT AS REPORTED BY TRW SYSTEMS GROUP, INC. (REFERENCE 19)
VARIOUS TOXICITY AND HAZARD DATA AS REPORTED BY TRW SYSTEMS GROUP, INC. (REFERENCE 19)
PRODUCTION RATING FOR PURE CONSTITUENT AS REPORTED BY BOOZ-ALLEN APPLIED RESEARCH (REFERENCE 10)
1.5 - PRODUCTION OR CONSUMPTION > 10⁸ LBS/YR
1.25 - PRODUCTION OR CONSUMPTION > 10⁷ LBS/YR BUT < 10⁸ LBS/YR
1.0 - PRODUCTION OR CONSUMPTION < 10⁷ LBS/YR
U - UNKNOWN
Waste Stream
SIC 333 Nonferrous
Brass Mill
Brass Mill Wastes
Concentration of Constituent in Stream (ppm)
Booz-Allen Ratings
Air
Water
Land
Production Rating
TRW Profile Number
Geographic Distribution
New England .04
Mid Atlantic .29
East North Central .01
West North Central .25
South Atlantic .01
East South Central .04
West South Central .04
West
Mountain
Production Quantity 5X10⁷
A-3
Specific Hazard Data (TRW, etc.)
Ref: Quantity taken from Booz-Allen Table III-6 quoted on dry weight basis
Processes which adequately treat a constituent
Constituents
Zinc 10,000
Sodium Dichromate 10,000 370
Sulfuric Acid 20,000
Bright Dip Liquor NA
TLV 0.1 mg/m³
Concentrate and precipitate
Concentrate and precipitate
Reduction and precipitate
Neutralize

NOTE: SPECIFIC WASTE STREAMS WERE NOT IDENTIFIED FOR ALL HAZARDOUS MATERIALS SELECTED BY TRW SYSTEMS GROUP, INC. THIS IS A REFLECTION OF THE FACT THAT HAZARDOUS MATERIALS MAY BE TOO VALUABLE TO BE WASTED, OR MAY BE WASTED IN A NON-HAZARDOUS FORM. FOR EXAMPLE, SILVER IODIDE IS RECOVERED RATHER THAN WASTED, AND HEXABORANE MAY APPEAR AS BORIC ACID WHEN WASTED.

TABLE A-1

U.S. BUREAU OF CENSUS REGIONS

Region 1, NE
New England

Maine
Vermont
New Hampshire
Massachusetts
Rhode Island
Connecticut

Region 2, MA
Mid Atlantic

New York
Pennsylvania
New Jersey

Region 3, ENC
East, North, Central

Wisconsin
Illinois
Indiana
Ohio
Michigan

Region 4, WNC
West, North, Central

North Dakota
South Dakota
Minnesota
Iowa
Nebraska
Kansas
Missouri

Region 5, SA
South Atlantic

Delaware
Maryland
Washington, D.C.
West Virginia
North Carolina
South Carolina
Florida
Virginia

Region 6, ESC
East, South, Central

Kentucky
Tennessee
Mississippi
Alabama

Region 7, WSC
West, South, Central

Texas
Oklahoma
Arkansas
Louisiana

Region 8, M
Mountain

Montana
Idaho
Wyoming
Nevada
Utah
Colorado
Arizona
New Mexico

Region 9, P
Pacific (W - West)

Washington
Oregon
California
Hawaii
Excludes Alaska

APPENDIX C

WASTE STREAM DATA SHEETS FOR WASTES WHICH QUALIFY AS HAZARDOUS UNDER BOTH THE PURE COMPOUND APPROACH AND THE WASTE STREAM DECISION MODEL

C-4

WASTE STREAM

SIC 011 Cash
TRW #8 P. 77
Grains SIC 07
Crop Services

Wastes from
Seed Industry

GEOGRAPHIC DISTRIBUTION	
New England	.017
Mid Atlantic	.088
East North Central	.371
West North Central	.213
South Atlantic	.053
East South Central	.060
West South Central	.081
West	.094
Mountain	.023

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Mercury												257	▨		Recycle, storage
Aliphatic Mercury Compounds												258	▨	TLV 0.01 mg/m^3 on skin. Toxic	Chlorinate. Reduce with $NaBH_4$ in caustic
Aromatic Mercury Compounds												258	▨	TLV 0.05 mg/m^3 on skin. Toxic	Chlorinate. Reduce with $NaBH_4$ in caustic
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

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WASTE STREAM

SIC 0175
Tree Fruits

Contaminated
Orchard Soil
(Stored)

GEOGRAPHIC DISTRIBUTION	
New England	.05
Mid Atlantic	
East North Central	.15
West North Central	
South Atlantic	.33
East South Central	
West South Central	.35
West	.09
Mountain	.03

Production Quantity
Unknown

C-4

SPECIFIC HAZARD DATA
(TRW, etc.)

Ref: TRW volume on waste forms

PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Arsenic Oxide and Arsenates	0-500	3	3	3	3	3	1	2	3	2	1.0	51		Toxic in all forms	Reduce volume and recycle or put in long-term storage

WASTE STREAM	GEOGRAPHIC DISTRIBUTION			
SIC 1021 Copper Ores Recovered Arsenic from Refinery Flues (Stored)	New England		C-4	Ref: TRW volume on waste forms
	Mid Atlantic			
	East North Central			
	West North Central			
	South Atlantic			
	East South Central			
	West South Central			
	West	1.0		
	Mountain		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 4X10^7		ASARCO - Tacoma, Washington
A_2O_3 AS_2O_3		3	3	3	3	3	1	2	3	2	1.0	56		Toxic in all forms	1) Long term storage 2) Recycle & reprocessing
Mercury												257			Recycle/storage

WASTE STREAM

SIC 1031
Lead and Zinc Ores

Zinc Ore Roasting Acid Wash

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

A-5

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
Mercury	100											257	▨	Bioaccumulative and toxic if methylated	Recycle/storage
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 1092
Mercury Ores
SIC 333 Smelting & Refining nonferrous Metals

Mercury Ore Extraction Wastes

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	
West	.72
Mountain	.28

C-4

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Mercury												257		Bioaccumulative and toxic if methylated	Recycle/storage

WASTE STREAM

SIC 1099

Metallic Ores

Cadmium Ore Extraction

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

A-5

Ref: Single plant estimate quoted 22.8 gal wastewater/lb Cd produced. Booz-Allen lists 13 X 10^6 lbs Cd prod. 1969. Assume 1% concentration to avoid cooling water etc. (Note-electrolytic plants can use 40 times as much water.)

Constituents	Concentration of Constituent in Stream (ppm)	Booz-Allen Ratings: Air Human	Air Ecological	Air Explosion	Water Human	Water Ecological	Water Explosion	Land Human	Land Ecological	Land Explosion	Production Rating	TRW Profile Number	Production Quantity $2X10^8$	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Cadmium Amino Complex	10,000													Cadmium is bioaccumulative and highly toxic	Precipitate and recycle
Ammonium Salts	20,000														
Metals	trace														

WASTE STREAM

SIC 22

Mercury Bearin
Textile Clean-
ing Wastes

A-5

GEOGRAPHIC DISTRIBUTION	
New England	.101
Mid Atlantic	.178
East North Central	.034
West North Central	.005
South Atlantic	.568
East South Central	.034
West South Central	.014
West	.060
Mountain	.006

Constituents	Concentration of Constituents in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human			WATER Human			LAND Human				TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating				
Mercury												257	▨	Bioaccumulative and toxic	Recycle/storage
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-5
SIC 2491 Wood Preserving; TRW #8 P. 77 2499 Misc. Wood Products; 2865 Ind. Org. Chem. Wood Prescrvative Wastes	New England	.007	
	Mid Atlantic	.029	
	East North Central	.117	
	West North Central	.060	
	South Atlantic	.267	
	East South Central	.141	
	West South Central	.174	
	West	.162	
	Mountain	.042	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
													$2x10^{11}$ (all SIC 24)		
Mercury		3	U	2	3	3	1	3	U	1	1.0	257			Recycle/storage
Aliphatic Mercury Compound		3	3	2	3	3	1	3	U	1	1.0	258		TLV 0.01 mg/m^3 on skin toxic	Chlorinate; reduce with NaBH$_4$ in caustic to elemental mercury
Aromatic Mercury Compound		3	3	2	3	3	1	3	U	1	1.0	258		TLV 0.05 mg/m^3 on skin toxic	" " "
Sodium Phenol Sulfonate	180,000														
Sodium Sulfate	280,000														

WASTE STREAM

SIC 26
TRW #8 P. 77

From Pulp and Paper Industry

GEOGRAPHIC DISTRIBUTION	
New England	.11
Mid Atlantic	.11
East North Central	.19
West North Central	.04
South Atlantic	.23
East South Central	.08
West South Central	.10
West	.11
Mountain	.03

B-2

Ref: Mercury wastes of concern come from on-site chlorine prod. and are included in the chlor-alkali waste estimate

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	 AIR Ecological	 AIR Explosion	 WATER Human	 WATER Ecological	 WATER Explosion	 LAND Human	 LAND Ecological	 LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
													7X10^9		
Zinc Hydrosulfide															
Mercury		3	U	2	3	3	1	3	U	1	1.0	257			Recycle, storage
Aliphatic Mercury Compounds		3	3	2	3	3	1	3	U	1	1.0	258		TLV 0.01 mg/m^3 on skin. Toxic	Chlorinate. Reduce with NaBH$_4$ in caustic
Aromatic Mercury Compounds		3	3	2	3	3	1	3	U	1	1.0	258		TLV 0.05 mg/m^3 on skin. Toxic	" " "
Barium Sulfide	trace	2	U	3	2	U	2	1	1	3	1.0	472		TLV 0.5 mg/m^3. Toxic when ingested. MPC in drink water 1.0 ppm. Sulfide may spontaneously ignite when in contact with moisture, air or acid.	1) Precipitation as sulfate with sulfuric acid 2) Ion exchange. 3) Reverse osmosis 4) Adsorption on activated carbon
Barium Carbonate		2	1	1	2	1	2	1	U	1	1.5	52			
Methyl Mercaptan	5.3# ton	2	2	2	2	2	3	2	2	U	1.0	272		MAC-50 ppm	1) Incinerate 2) Activated carbon
Hydrogen Sulfide	.66# ton	3	2	3	3	1	3	3	2	2	1.25	221		TLV 10 ppm Fatal at 700-1000 ppm in 30 min.	1) Numeration 2) Amine scrubbing 3) Class process 4) Activated Sludge
Sulfur Dioxide		3	2	2	3	2	3	3	2	3	1.5				
Hexone		2	2	1	2	1	1	2	1	U	1				

WASTE STREAM

SIC 2611
Pulp Mills
TRW #4 P. 58

Dimethyl Sulfate Prod.
Still Bottoms

C-5

Ref: TRW final report

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	X
East North Central	
West North Central	
South Atlantic	X
East South Central	
West South Central	
West	
Mountain	

Production Quantity
$2X10^5$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Dimethyl Sulfate	1%	3	3	2	3	U	1	3	U	2	1.0	160	TLV, 1 ppm or 5 mg/m^3. TRW recommendation: 0.01 ppm or 0.05 mg/m^3	1) Dilution with water and titration with base (best method) 2) Incineration after dilution 3) Biological wastewater treatment after dilution and neutralization

WASTE STREAM

SIC 2812
Alkalies and
Chlorine

Chlorine Production Brine
Sludges

GEOGRAPHIC DISTRIBUTION	
New England	.009
Mid Atlantic	.186
East North Central	.087
West North Central	
South Atlantic	.203
East South Central	.433
West South Central	.050
West	.032
Mountain	

A-5

Ref: TRW volume on waste forms

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity x10^8	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Mercury Salts		3	3	2	3	3	1	3	U	2	1.0				
Aliphatic Organo-mercury		3	3	2	3	3	1	3	U	1	1.0	258		TLV 0.01 mg/m^3 on skin. Toxic	Chlorinate. Reduce with $NaBH_4$ in caustic
Aromatic Organo-mercury		3	3	2	3	3	1	3	U	1	1.0	258			
Calcium Oxide		3	2	2	3	U	1	1	U	2	1.0				
Asbestos		3	U	1	1	U	1	1	U	1	1.5				
Lead		3	2	2	3	U	1	1	U	2	1.5	233			Concentrate/precipitate
Chlorinated Hydrocarbons														TLV 0.01 mg/m^3	Incineration with scrubbing
Sulfuric Acid		3	2	2	3	3	2	3	U	2	1.5				Neutralization

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		Waste Stream Continued	Ref: Direct plant contact
SIC 2813 TRW #6 P. 83 Ind. Gases; 2819 Ind. Inorganic Chemicals; 3674 Semi- conductors; 2821 Elastomers (Plastic)	New England		Only Producer Callery Chem. Co. Callery, Pa. Borane Prod. Wastes	Matheson Gas Prod. High value of prod. leads to extensive recovery
	Mid Atlantic	1.00		
	East North Central			
	West North Central			
	South Atlantic			
	East South Central			
	West South Central			
	West			
	Mountain			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Neg.		Callery, Pa. Produced Employed Edwards Air Force Base
Diborane												61	▨	TLV 0.1 ppm. Minimum level detectable by odor is 3.3 ppm Very toxic. Also prone to instability in presence of oxidizing impurities	1) Burn and scrub exhaust or 2) Hydrolyze and evaporate to boric acid
Penta-borane-9		3	3	3	3	1	U	3	3	3	1.0	61	▨	TLV 0.005 ppm. Minimum level detectable by odor is 0.8 ppm Unstable in presence of oxi-dizing impurities	1) and 2) above
Decaborane												61	▨	TLV 0.05 ppm. Minimum level detectable by odor is 0.7 ppm Unstable in presence of oxi-dizing impurities	1) and 2) above
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2813 TRW #5 (V. 2) P. 362 Ind. Gases; 3341 Sec. Smelting Non-ferrous Metals Nickel Carbonyl Prod. Wastes	New England			Ref: Direct contact Matheson Gas Prod. Attempt to recover all nickel from returned cylinders. Occasionally bury one with corroded valves
	Mid Atlantic	1.000		
	East North Central			
	West North Central			
	South Atlantic			
	East South Central			
	West South Central			
	West			
	Mountain			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity Neg.	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Nickel Carbonyl		3	2	3	1	1	3	1	2	3	1.0	293		TLV, 0.001 ppm. Explosive at 3~34% volume in air	1) Recycling and reprocessing for large quantities of the wastes) 2) Thermal decomposition and wet scrubbing

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		
SIC 2813 TRW #3 P. 66 Ind. Gases SIC 376 Guided missile & space vehicle Waste Chlorine Trifluoride	New England		Ref: Estimate based on low production
	Mid Atlantic		
	East North Central	X	
	West North Central		
	South Atlantic		
	East South Central		
	West South Central	X	
	West		
	Mountain		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity Neg.	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chlorine Trifluoride		3	3	3	3	2	U	3	3	U	1.0	106	▨	TLV 0.1 ppm (ACG-IH) React violently with small amounts of water. Supports combustion of sand, ground glass and asbestos. Reacts with most metals at elevated temperatures.	1) React with charcoal bed Producing carbon tetrafluoride which is inert and chlorine which is removed by caustic scrubbing. 2) Feed into propane burner and remove hydrogen fluoride and hydrogen chloride formed by scrubbing. 3) Discharge into large volume water spray and treat resulting hydrochloric, hydrochlorous, and hydrofluoric acids with lime.

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2813 TRW #3 P. 66 Industrial Gases SIC 376 Guided Missile & space vehicles Waste Chlorine Pentafluoride	New England			Ref: Estimate based on low production
	Mid Atlantic			
	East North Central	X		
	West North Central			
	South Atlantic			
	East South Central			
	West South Central	X		
	West			
	Mountain			
	Production Quantity Neg.			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number		SPECIFIC HAZARD DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chlorine Pentafluoride												106		Toxic and corrosive oxidizing agent. TLV not established but probably should be about 0.1 ppm.	1) React with charcoal bed producing carbon tetrafluoride which is vented and chlorine which is removed by caustic scrubbing. 2) Feed into propane burner and remove hydrogen fluoride and hydrogen chloride formed by scrubbing. 3) Discharge into large volume water spray and treat resulting hydrochloric hydrochloris, and hydrofluoric acids with lime.

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	1.000
West	
Mountain	

Ref: Estimate based on low production

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2813 Industrial Gases Waste Bromine Pentafluoride	▨	3	2	U	3	2	U	3	2	U	1.0	▨	Neg.	Max. allowable conc. 0.1 ppm/8 hr. corrosive	React with charcoal bed to produce carbon tetrafluoride and bromine which is collected in cold trap scrubber.
Constituents															
												66	▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-5	Ref: Estimate by contact at Matheson Gas, Rutherford, New Jersey plant. - Mr. Ray Ratcliff
SIC 2813 Industrial Gases Arsine Production Wastes	New England	X		
	Mid Atlantic	X		
	East North Central	X		
	West North Central			
	South Atlantic			
	East South Central	X		
	West South Central	X		
	West	X		
	Mountain		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituents in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 1X10		
Arsenates												46	▨		Long-term storage
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	C-5	Ref:
SIC 2815-2818 Ind. Org. Chem. Acetaldehyde via Ethylene Oxidation		Booz-Allen Table III-6 Still Bottoms

GEOGRAPHIC DISTRIBUTION	
New England	.015
Mid Atlantic	.170
East North Central	.156
West North Central	.047
South Atlantic	.156
East South Central	.111
West South Central	.265
West	.060
Mountain	.020

Production Quantity $8X10^7$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating 12,000 gal/ton produced	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Acetaldehyde Still Bottoms	NA												Nonbiodegradable	
Organic Chlorides	46#/ 1,000# Prod.													
Methyl Mercury Chloride	15-20	3	3	2	3	3	1	3U			11.0	258	Methyl mercury forms are highly toxic and bioaccumulative	Reduce to metallic mercury and recycle

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: Booz-Allen Table III-6 dry weight basis as zinc, chromium and organic chlorides
SIC 2818 Ind. Org. Chem. Via Co Synthesis Co Synthesis Methanol Prod Wastes	New England			
	Mid Atlantic			
	East North Central	.05		
	West North Central			
	South Atlantic	.05		
	East South Central			
	West South Central	.90		
	West			
	Mountain		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity $1X10^6$ Sludge			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number		
		AIR			WATER			LAND						
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	.612#/1,000# Production Rating			
Organic Chloride	$.1810^6$ 1,000#													
Chromic Sulfate	.01 1,000#	3	2	2	3	3	1	3	3	1	1	486	TLV 0.5 ppm	1) Ion exchange 2) Discharge to main sewer 3) Direct precip.
Zinc Chloride	.011# 1,000#	2	3	2	1	3	1	2	U2		1.25			Concentrate/precipitate

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	 AIR Ecological	 AIR Explosion	 WATER Human	 WATER Ecological	 WATER Explosion	 LAND Human	 LAND Ecological	 LAND Explosion	Production Rating 5x10^6 tons acid/yr	TRW Profile Number	GEOGRAPHIC DISTRIBUTION		A-5	Ref: Process not in commercial use in U.S. at present time. May be important in the future.
SIC 2819 In. Inorg. Chem. Arsenic Wastes from Purification of Phosphoric													New England	.015		
													Mid Atlantic	.170		
													East North Central	.156		
													West North Central	.047		
													South Atlantic	.156		
													East South Central	.111		
													West South Central	.265		
													West	.060	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
													Mountain	.020		
	▨											▨	Production Quantity Neg.			
Constituents													▨			
Arsenic Sulfide	80,000											46	▨		Not yet listed as HM (may not be because of low stability, natural occurrence)	
Hydrofluoric Acid		3	2	2	3	3	2	3	U	3	1.5		▨		Burns skin, eyes, mucosa. Max drinking water levels 0.8-1.7 mg/l - <2.4 mg/l for livestock	Lime and landfill. CaF_2 product
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			

WASTE STREAM

SIC 2819 Ind.
Inorg. Chem.
TRW #3 Mo. Rpt
P. 75

Contaminated
Fluorine

GEOGRAPHIC DISTRIBUTION	
New England	.007
Mid Atlantic	.101
East North Central	.166
West North Central	.075
South Atlantic	.147
East South Central	.207
West South Central	.147
West	.096
Mountain	.054

Production Quantity
Neg.

Ref: Estimate based on low production

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Silicon Tetra-fluoride														
Carbon Tetra-fluoride													Relatively nontoxic and chemically inert	Vent (gas)
Hydrogen Fluoride		3	2	2	3	3	2	3	U	3	1.5		TLV 3 ppm	React with lime or limestone. Dispose of calcium fluoride formed by landfill
Carbon Dioxide														Vent
Fluorine		3	3	2	3	3	1	3	U	2	1.5	200	TLV 0.1 ppm. High concentration of the gas and the liquid will initiate spontaneous combustion of flammable materials	1) Burn in fluorine - hydrocarbon air burner followed by caustic scrubber and stack 2) React with charcoal bed forming carbon tetrafluoride This method can also be used t to treat interhalogens and is recommended

WASTE STREAM

SIC 2819 Ind.
Inorg. Chem.

Sodium Dichromate Prod.
Wastes

GEOGRAPHIC DISTRIBUTION

New England	.15
Mid Atlantic	.25
East North Central	.025
West North Central	.24
South Atlantic	.025
East South Central	.11
West South Central	.15
West	.05
Mountain	

C-4

Ref: Booz-Allen Table III-6
dry weight as chromium

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	1#/ton Prod. Production Rating	TRW Profile Number	Production Quantity 3X10^8	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chromium Salts		3	3	1	3	2	1	3U	1	1.5	386			TLV .1 mg/m^3	Reduction & Precipitate Electro reduction
Sodium Sulfate															

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		B-1	Ref: Estimated based on low production
SIC 2819 Ind. Inorganic Chemicals TRW #6, p. 57 Waste from manuf. of barium compounds	New England	.007	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mid Atlantic	.101		
	East North Central	.166		
	West North Central	.075		
	South Atlantic	.147		
	East South Central	.207		
	West South Central	.147		
	West	.096		
	Mountain	.054		
	Production Quantity Neg.			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Specific Hazard Data	Processes Which Adequately Treat a Constituent
Barium Carbonate		2	1	1	2	1	2	1	U	1	1.5	52	Soluble barium compounds are highly toxic when ingested. TLV 0.5 mg/m^3 for all soluble barium compounds in air. Maximum permissible limit for barium in public water supplies is 1.0 ppm. Maximum concentration for cyanides in public water supplies is 0.01 ppm. Barium nitrate is an oxidizing material. Barium sulfide may spontaneously ignite when in contact with moisture, air or acid fumes.	1) Precipitation as barium sulfate by addition of sulfuric acid. Cyanide can be removed by oxidation to CO_2 and N_2 by alkaline chlorine solution. 2) Ion exchange to remove barium. 3) Reverse osmosis. 4) Adsorption on activated carbon.
Barium Chloride		2	2	1	3	3	2	1	U	1	1.0	53		
Barium Cyanide		3	U	2	3	U	2	2	U	2	1.0	469		
Barium Nitrate		2	U	2	2	2	1	1	U	2	1.0	471		
Barium Sulfide		2	U	3	2	U	2	1	U	3	1.0	472		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	A-2	Ref: Estimated based on low production
SIC 2819 Waste or Contaminated Perchloric Acid (72%)	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity Neg		

		BOOZ-ALLEN RATINGS													
		AIR			WATER			LAND							
Constituents	Concentration of Constituent in Stream (ppm)	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Perchloric Acid	≤72%	3	U	2	3	3	1	3	U	2	1.5	324		Slightly toxic, highly corrosive to skin. Can undergo spontaneous explosion in storage.	Reduce with thiosulfate, bisulfite or a ferrous salt acidified with 3M-H_2SO_4

WASTE STREAM

SIC 2819
Ind. Inorganic Chemicals

TRW #6, p. 221

Wastes from Manuf. of Mercuric Cyanide

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	1.0
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	
West	
Mountain	

Production Quantity Neg.

B-1

Ref: Estimate based on low production

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Neg.		
Mercuric Cyanide		3	U	2	3	3	1	3	U	2	1.0	254	▨	Decomposed to mercury and cyanide when heated to 320°C TLV for mercury 0.1 mg/m^3. TLV for cyanides 11 mg/m^3 both are protoplasmic poisons Explosive compounds can be formed during its preparation	1) Alkaline chlorination to destroy CN^-, followed by reduction of mercury ions to metallic mercury with sodium borohydride. 2) Ion exchange.

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-5	
SIC 2821 Cellulose Esters	New England	.10		Ref: Total plastics and resin Hg consumption 1X10^5. .015-.1 lbs Hg wastes/lb prod. according to Nemerow "Liquid Waste of Industry" 1971. 5X10^8 lbs cellulosics annual prod.
	Mid Atlantic	.21		
	East Nor h Central	.21		
	West North Central	.16		
	South Atlantic	.14		
	East South Central	.07		
	West South Central	.10		
	West	.02		
	Mountain		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 5X10^7	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Acetic Acid		2	1	2	2	3	1	2	2	U	1.5				
Sulfuric Acid		3	2	2	3	3	2	3	U	2	1.5				Neutralization
Mercury Chlorides		3	3	2	3	3	1	3	U	1	1.0	253		Bioaccumulative and toxic	

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2821 TRW #8 P. 26 Plastics, Resins, Elastomers; 2824 Synthetic Fibers Residues from Mfg. of Ethylene Dichloride Vinyl Chloride	New England	–	C-5	Ref: Booz-Allen Table III-6 dry weight as organic chlorides
	Mid Atlantic	.021		
	East North Central	.015		
	West North Central	--		
	South Atlantic	.163		
	East South Central	.171		
	West South Central	.533		
	West	.117		
	Mountain	–		
	Production Quantity $2X10^7$			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Various Amounts of Solvent, Chlorinated and non-chlorinated materials													0.01 TLV for chlorinated hydrocarbons	Incineration with scrubbing
Allyl Chloride	50,000	3	U	2	3	1	1	3	U	1	1.0	15		
Methyl Mercuric Chloride	15 - 20	3	3	2	3	3	1	3	U	1	1.0	258		

WASTE STREAM

SIC 2822
TRW #8 P. 77
Syn. Rubber;
2821 Plastics, Resins, Elastomers
Urethane Manuf Wastes

GEOGRAPHIC DISTRIBUTION	
New England	.046
Mid Atlantic	.121
East North Central	.101
West North Central	.018
South Atlantic	.404
East South Central	.182
West South Central	.101
West	.027
Mountain	-

Production Quantity
2×10^{12} (all SIC 282)

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Mercury		3	U	2	3	3	1	3	U	1	1.0	257		Recycle/storage
Aliphatic Mercury Compounds		3	3	2	3	3	1	3	U	1	1.0	258	TLV 0.01 mg/m^3 on skin toxic	Chlorinate. Reduce with NaBH in caustic to elemental mercury
Aromatic Mercury Compounds		3	3	2	3	3	1	3	U	1	1.0	258	TLV 0.05 mg/m^3 on skin toxic	" " "

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		B-1
SIC 2822 Syn. Fiber Syn. Rubber; 2821 Plastics, Resins, etc.; 2824 Syn. Organic Fibers	New England	.046	
	Mid Atlantic	.121	
	East North Central	.101	
	West North Central	.018	
	South Atlantic	.404	
Aqu. or Org. Liqd. or Slurry	East South Central	.182	
	West South Central	.101	
	West	.027	
	Mountain	-	
Adiponitrile	Production Quantity $2x10^{12}$ (all SIC 282)		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Adiponi-trile	20,000 -1,000,000	2	3	2	3	3	1	1	U	2				Subject to biological action when dilute
Polymer Solids	50,000 -- 00,000													
Water or Organic Solvent														
Hydrogen Cyanide		3	3	3	3	3	2	3	U	2	1.5	218	TLV 11 mg/m^3. Protoplasmic poison can be explosive. Hydrocyanic poison formed at low pH is extremely toxic.	1) Incineration with NO_x scrubbing 2) Scrub with potassium or sodium to form cyanide salts
Phosgene												101	TLV 1 ppm	1) Dilution to 1 ppm 2) Scrub with caustic 3) React with alcohol 4) Elevated temp. hydrolysis with steam and Na_2CO_3 scrubbing

WASTE STREAM	SIC 2822, Synthetic Rubber; 3011 Tires and Tubes; 3021 Rubber and Plastic Footwear; 3031 Reclaimed Rubber; 3041 Hoses and Belts; 3069 Mis. Rubber TRW #4 P. 118 Continued--

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	.07
East North Central	.14
West North Central	
South Atlantic	.11
East South Central	.11
West South Central	.50
West	.07
Mountain	

Production Quantity 5X10⁷

Waste Stream C-5
Continued--

Nitrobenzene from Rubber Industry Wastes

Ref: 1 gal/lb Single company estimate Ohio discharge permits, $2X10^6$ lbs prod/day. The nitrobenzene waste stream should be segregated and is probably of much smaller volume

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 5X10⁷	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Nitrobenzene		3	2	3	3	3	1	3	U	3	1.5	301		Max. allow. conc., 1 ppm (or 5 mg/m^3). Acute aquatic toxicity, 30 ppm	1) Incineration (for concentrated wastes) 2) Return to mfg for reprocessing (for conc. wastes) 3) Activated sludge (for dilute solutions)
															*Candidate!

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 283 Drugs Drug Manuf. Wastes in Total Summary of Next 4 Streams													New England .056 Mid Atlantic .348 East North Central .183 West North Central .089 South Atlantic .100 East South Central .033 West South Central .060 West .115 Mountain .011	C-5	Ref: Water use data for entire industry - Booz-Allen
	▨											▨	Production Quantity $5X10^9$		
Constituents													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 283 Drugs
TRW #8 P. 77

Mercurial Pharmaceutical Wastes

GEOGRAPHIC DISTRIBUTION	
New England	.056
Mid Atlantic	.348
East North Central	.183
West North Central	.089
South Atlantic	.100
East South Central	.033
West South Central	.060
West	.115
Mountain	.011

A-5

Ref: Industry achieves nea total recycles - TRW via direct plant contact

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity Neg.	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Mercury		3	U	2	3	3	1	3	U	1	1.0	257			Recycle, storage
Aliphatic Mercury Compounds		3	3	2	3	3	1	3	U	1	1.0	258		TLV 0.01 mg/m^3 on skin. Toxic	Chlorinate. Reduce with $NaBH_4$ in caustic.
Aromatic Mercury Compounds		3	3	2	3	3	1	3	U	1	1.0	258		TLV 0.05 mg/m^3 on skin. Toxic	" "

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TBW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 283 Drugs Nitrite Containing Pharmaceutical Wastes	▨											▨	New England .056 Mid Atlantic .348 East North Central .183 West North Central .089 South Atlantic .100 East South Central .033 West South Central .060 West .115 Mountain .011		
Constituents													Production Quantity		
Phosgene												101	▨	TLV 1 ppm	1) Dilution to 1 ppm 2) Scrubbing with caustic ~~3) Reaction with alcohols~~ 4) Elevated temp. hydrolysis with steam and Na_2CO_3scrubbing
													▨		(Not developed yet).
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 283 Drugs Organic Pharmaceutical Waste	New England	.056
	Mid Atlantic	.348
	East North Central	.183
	West North Central	.089
	South Atlantic	.100
	East South Central	.033
	West South Central	.060
	West	.115
	Mountain	.011

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chlorobenzene	50,000 300,000	2	1	2	2	3	1	1	U	2	1.5	108		96hr TLm for fathead minnow-29ppm 2ppm can injure algae in 21 days	1) Incineration with alkaline scrubbing 2) Carbon sorption 3) Activated Sludge
Toluene		2	1	2	2	3	1	2	U	2	1.5	434		96hr TLm for mosquito fish-1180ppm	
Methanol		2	2	2	3	2	1	2	U	2	1.5	261		1 oz. can be fatal to humans, suggested drinking water limit .021 ppm	" "
Methylene Dichloride	-600,000													1.3mg 1kg body weight suggested maximum intake for humans	" "
Pyridine	-200,000	2	1	2	2	2	1	1	U	2	1.0	364		Suggested drinking water limits-.25ppm 96hr TLm for mosquito fish-1350ppm 1ppm inhibits biochemical oxidation	" "
Tetrachloroethane		3	3	2	3	U	1	2	U	2	1.5			LDCA for Dogs-750mg 1kg body weight chronic exposure can result in liver damage	" "
Trichloroethylene		3	1	2	2	2	1	2	U	2	1.5	438		Fish were stupefied when exposed for 16 hours to 55ppm.	" "
Benzo-Tri fluoride															" "
Chlorosulfonic Acid		3	U	2	3	3	2	3	U	2	1.5	112		Violently reactive with water	" "

WASTE STREAM

SIC 283 Drugs

Pharmaceutical Arsenic Waste

GEOGRAPHIC DISTRIBUTION

New England	.056
Mid Atlantic	.348
East North Central	.183
West North Central	.089
South Atlantic	.100
East South Central	.033
West South Central	.060
West	.115
Mountain	.011

A-5

Ref: Industry achieves near total recycles - TRW via direct plant contact

Production Quantity Neg.

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Inorganic Arsenites	20,000 30,000											377	Not yet listed as HM	Concentrate/long-term storage
Organic Arsenites	10,000 20,000													Concentrate/long-term storage
Arsenylic Acid	10,000 20,000												Not yet listed as HM	Concentrate/long-term storage
Sodium Chloride	10,000													

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: Volume on waste forms
SIC 285 Solvent Based Paint Sludge	New England	.044		
	Mid Atlantic	.243		
	East North Central	.269		
	West North Central	.072		
	South Atlantic	.103		
	East South Central	.041		
	West South Central	.069		
	West	.147	SPECIFIC HAZARD DATA (TEW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mountain	.012		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS: AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TEW Profile Number	Production Quantity 4X10^7	Specific Hazard Data	Processes
	▨											▨			
Lead	637,000#	3	2	2	3	U	1	1	U	2	1.5	233	▨		Concentrate/precipitate
Chromium	137,000#	3	2	2	3	3	1	3	U	2	1.25	113	▨	TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water	Ion exchange, activated carbon, or chemical reduction and precipitation
Cadmium	5,100 tr	3	3	2	2	3	1	2	U	3	7.25	85	▨		1) Carbon adsorption 2) Lime coagulation, sedimentation, sand bed filtration
Selenium	370#	3	3	2	2	3	1	2	U	3	1.0	367	▨		
Cyanides	44,900#	3	U	2	3	U	2	2	U	2	1.0	129	▨	TLV 5 mg/m^3	Alkaline Oxidation
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 285

Water-Based Paint Sludge

C-4

Ref: Volume on waste forms

GEOGRAPHIC DISTRIBUTION	
New England	.044
Mid Atlantic	.243
East North Central	.269
West North Central	.072
South Atlantic	.103
East South Central	.041
West South Central	.069
West	.147
Mountain	.012

Production Quantity 3X10^7

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	Ecological	Explosion	WATER Human	Ecological	Explosion	LAND Human	Ecological	Explosion	Production Rating	TSM Profile Number		SPECIFIC HAZARD DATA (TSM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chromium	9,8000	3	2	23	3	1	3	U2			1.25	113		TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water	Ion exchange, activated carbon, or chemical reduction and precipitation
Mercury	1,8000	3	U	23	3	1	3	U1			1.0	257			Recycle/storage

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOS-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	A-5 SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2865 Enamels 2865 Inks 285 Paints 2821 Plastics 2822 Rubber Cadmium-Selenium Pigment Wastes		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Cadmium		3	3	2	3	U	1	1	U	2	1.2	82		Bioaccumulative and toxic	
Selenates															
Selenium		3	3	2	2	3	1	2	U	3	1.0	367			

WASTE STREAM

SIC
2865 Enamels
2865 Inks
285 Paints
2821 Plastics
2822 Rubber

Cadmium-Selenium Pigment Wastes

A-5

GEOGRAPHIC DISTRIBUTION

New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	West	Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TSW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TSW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
Cadmium		3	3	2	3	U	1	1	U	2	1.2	82	▨	Bioaccumulative and toxic	
Selenates													▨		
Selenium		3	3	2	2	3	1	2	U	3	1.0	367	▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2865 Wood Preserving Ind. Organ. Chem.; 2491 Wood Preserving; 2499 Misc. Wood Products Spent Wood Preserving Liquid	▨											▨	New England .053 Mid Atlantic .199 East North Central .317 West North Central .105 South Atlantic .080 East South Central .079 West South Central .101 West .027 Mountain - Production Quantity 4×10^2 (all SIC289)	C-5	Ref: TRW monthly report
Constituents													▨		
Pentachlorophenol	50,000	3	3	2	3	3	1	3	3	1	1.25	322	▨		
Water	Bal.												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2865 Ind. Organic Chem. Dye Manufacturing Wastes		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	C≤5	
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Constituents													Production Quantity $1.1x10^{11}$ (all SIC286		
Copper	900	2	2	2	2	3	1	2	2	2	1.0				Concentrate/precipitate
Chromium	100	3	2	2	3	3	1	3	U	2	1.2	113		TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water	Ion exchange, activated carbon, or chemical reduction and ppt
Phenols	400	3	2	2	3	1	3	3	2	U	1.5				
Hydrogen Cyanide		3	3	3	3	3	2	3	U	3	1.5	218		TLV 11 mg/m^3. Protoplasmic poison. Can be explosive. Hydrocyanic acid is especially toxic	1) Incineration with NO_x scrubbing 2) Scrub with potassium or sodium hydroxide to form cyanide salts
Aniline		3	1	2	3	2	1	3	U	2	1.5				
Disulfonic Acid															

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2865 TRW #4 P. 20 Ind. Organic Chem. 2816 Inorg. Pigments Chromates Wastes from Pigments and Dyes	▨											▨	New England .015 Mid Atlantic .170 East North Central .156 West North Central .047 South Atlantic .156 East South Central .111 West South Central .265 West .060 Mountain .020 Production Quantity 1.1x10^{11} (all SIC286	C-1	
Constituents															
Chromates (C_r^{+3})	58											386	▨	TLV, 0.5 mg/m^3.	1) Ion exchange 2) Discharge to municipal 3) Direct precipitation
Chromic Hydroxide Sludge													▨		1) Landfill 2) Ocean disposal 3) Incineration and Landfill
Sulfides	221											221	▨		
Diphenylamine		3	2	2	3	U	1	1	U	1	1.25	167	▨	TLV 10 mg/m^3.	1) Incineration (conc. wastes 2) Landfill (more dilute)
Dinitrotoluene		3	U	3	3	3	1	2	U	2	1.5	165	▨	TLV 1.5 mg/m^3. Explodes @ 310°C in 5 sec.	Incineration
Nitrobenzene		3	2	3	3	3	1	3	U	3	1.5	301	▨	Max. Allow. Conc. 1 ppm (5 mg/m^3). Acute aquatic toxicity 30 ppm	1) Incineration (conc. wastes 2) Return conc. streams for reprocessing 3) Activ. sludge for dilute wastes.
													▨		
Nitroaniline		3	1	3	3	3	1	3	U	1	1.25	300	▨	TLV 6 mg/m^3	1) Incineration (conc. wastes) 2) Activ. sludge for dilute wastes
Phosgene												101	▨	TLV 1 ppm	1) Dilute to 1 ppm 2) Scrub with caustic 3) React with alcohols 4) Hydrolyze @ elevated temp. with steam & Na_2CO_3 scrubbing

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2865 TRW #4 P. 20 Ind. Organic Chem. 2816 Inorg. Pigments Chromates Wastes from Pigments and Dyes	New England	.015
	Mid Atlantic	.170
	East North Central	.156
	West North Central	.047
	South Atlantic	.156
	East South Central	.111
	West South Central	.265
	West	.060
	Mountain	.020
	Production Quantity $1.1x10^{11}$ (all SIC286	

C-1

Constituents	Concentration of Constituent in Stream (ppm)	BOOS-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chromates $(C_r{}^{+3})$	58											386	TLV, 0.5 mg/m^3.	1) Ion exchange 2) Discharge to municipal 3) Direct precipitation
Chromic Hydroxide Sludge														1) Landfill 2) Ocean disposal 3) Incineration and Landfill
Sulfides	221											221		
Diphenylamine	,	3	2	2	3	U	1	1	U	1	1.2	167	TLV 10 mg/m^3.	1) Incineration (conc. wastes 2) Landfill (more dilute)
Dinitrotoluene		3	U	3	3	3	1	2	U	2	1.5	165	TLV 1.5 mg/m^3. Explodes @ 310°C in 5 sec.	Incineration
Nitrobenzene		3	2	3	3	3	1	3	U	3	1.5	301	Max. Allow. Conc. 1 ppm (5 mg/m^3). Acute aquatic toxicity 30 ppm	1) Incineration (conc. wastes 2) Return conc. streams for reprocessing 3) Activ. sludge for dilute wastes.
Nitroaniline		3	1	3	3	3	1	3	U	1	1.2	300	TLV 6 mg/m^3	1) Incineration (conc. wastes 2) Activ. sludge for dilute wastes
Phosgene												101	TLV 1 ppm	1) Dilute to 1 ppm 2) Scrub with caustic 3) React with alcohols 4) Hydrolyze @ elevated temp. with steam & Na_2CO_3 scrubbing

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2869 TRW #6 P. 47 Ind.Org. Chem.; 2822 Syn. Rubber; 2879 Pesticides; 2819 Ind. Inorganic Chemicals Contaminated Antimony Pentafluoride	▨											▨	New England Mid Atlantic X East North Central X West North Central South Atlantic East South Central West South Central X West Mountain Production Quantity Neg.		Ref: Estimate based on low production
Constituents													▨		
Antimony Pentafluoride		3	2	2	3	1	U	2	2	U	1.0	36	▨	TLV for antimony compounds is 0.5 mg/m^3. Recommended exposure level to antimony pentafluoride is 0.0005 mg/m^3/24 hrs. Lethal dosages as low as 3 grains/24 hrs have been reported. Lethal to fish at concentrates of 100-200 ppm. In addition to its toxicity, antimony pentafluoride also exhibits the caustic effects of hydrofluoric acid	1) None developed. Return to manufacturer for recycle. (Note: Adequately contained during manufacture, so amounts to be disposed of probably minor)

WASTE STREAM	Concentration of Constituents in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TSW Profile Number	GEOGRAPHIC DISTRIBUTION	C-1 SPECIFIC HAZARD DATA (TLV, etc.)	Ref: Production figure COM-72-10419 Interdepartmental Task Force on PCB's May 1972 PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2869 Chemical Ind. Org. Chem.; 2899 Misc. Chem. Products; 3612 Transformers Org. Lign Contaminated PCB	▨											▨	New England .037 Mid Atlantic .221 East North Central .372 West North Central .153 South Atlantic .040 East South Central .041 West South Central .057 West .072 Mountain .009 Production Quantity $8x10^6$		
Constituents													▨		
Polychlorinated Biphenols	90%	3	U	2	2	U1		2	U	1	1.0	507	▨	TLV 0.5-1.0 mg/m^3	1) Special high temperature incineration with scrubbing
													▨		2) Clay filtering of concentrated wastes
Alpha Methyl Styrene	10%												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: Estimate based on low production
SIC 2869 Ind. Org. Chem. TRW #6 P. 131 SIC 9711 Nat. Security Also per Stored War Gas from the Manu of Chloropi-crin	New England			
	Mid Atlantic	X		
	East North Central			
	West North Central	X		
	South Atlantic			
	East South Central			
	West South Central			
	West	XX		
	Mountain			
	Production Quantity Neg.			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
Chloropicrin												111	▨	4 ppm in air will render a man unfit for action and 20 ppm will cause bronchiolar pulmonary lesions after one or two minutes. Chloroprpicrin emits highly toxic fumes when heated to decomposition. TLV 0.01	1) Incineration with scrubbing to remove hydrogen chloride, hydrochloric acid and nitrogen oxides 2) Lagooning dilute wastes to allow out-gassing
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-5	
SIC 2869 TRW #6 P. 249 Ind.Org.Chem. from the Manuf of Tetraethyl - and Tetramethyl Lead	New England			Ref: 50 tons/yr in San Francisco area, "Selected Problems of Hazardous Waste Management in California," Jan. 1970. Antioch plant is 340/895 of total national capacity for alkyl leads - SRI Directory of Chemical Producers - 1972.
	Mid Atlantic			
	East North Central			
	West North Central			
	South Atlantic			
	East South Central	0.630		
	West South Central			
	West			
	Mountain	0.730	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity 3X10^5			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Specific Hazard Data	Processes Which Adequately Treat a Constituent
Tetraethyl Lead		3	2	3	3	1	3	3	2	3	1.5	425	Extremely toxic materials. TLV 0.075 mg/m^3. Fire hazard when exposed to heat and flame	1) Incineration followed by scrubbing 2) Ion exchange
Tetramethyl Lead		3	2	2	3	1	U	3	2	3	1.25	427	" " "	" " "

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-6	Ref: Booz-Allen Table III-6 - dry weight basis chromium and zinc
SIC 287 Agric. Chemicals Ag. Chem. (Intermed. Ag. Prod. Wastes) Nitric Acid	New England	.005		
	Mid Atlantic	.075		
	East North Central	.145		
	West North Central	.074		
	South Atlantic	.299		
	East South Central	.207		
	West South Central	.090		
	West	.058		
	Mountain	.046	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity $2X10^5$			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Nitric Acid 283	1,000# 1,000T Prod.	3	3	1	3	3	2	3	2	1	1.5			Neutralization
Sodium Chromate 357	39# 1,000T Prod.	3	3	1	3	2	1	3	U	1	1.5	386	TLV, 0.1 mg/m^3	1) Red. precip. 2) Electro red. 3) Direct precip.
Zinc Chloride 418	10# 1,000T Prod.	2	3	2	1	3	1	2	U	2	1.25			Concentrate/percipitate

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2879 Carbonate Pesticide Manufacturing DOD Activities													New England Mid Atlantic East North Central West North Central .006 South Atlantic .848 East South Central West South Central West .145 Mountain	C-1	Ref: TRW volume on waste forms
	▨											▨	Production Quantity 320		
Constituents															
Manganese Thiocarbonate	160,000												▨		
Zinc	20,000												▨		Concentrate/percipitate
Bux Ten													▨		
Carbaryl													▨	LD50 for rats-540mg/Kg body weight 96hr LC50 for Bluegill-6.76 ppm. Potentially genetically active degradation products	Incineration
Carbofuran													▨	LD50 for rats-11 mg/Kg body weight	" "
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2879 Agric Pesticides Rollins Agricultural Pesticide Arsenic Wastes	New England	.005
	Mid Atlantic	.075
	East North Central	.145
	West North Central	.074
	South Atlantic	.299
	East South Central	.207
	West South Central	.090
	West	.058
	Mountain	.046

A-5

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity $1.9x10^{12}$ (all SIC287	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT NDS
Arsenic Trioxide	30,000	3	3	3	3	3	1	2	3	2	1.0	51	▨	Arsenic is toxic in all forms	Concentration/long-term storage
Arsenic Acid	trace												▨	" "	Concentration/long-term storage
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW volume on waste forms
SIC 2879 Pesticides Benzoic Herbicide Production Wastes DOD Related	New England	.168		
	Mid Atlantic	.130		
	East North Central	.009		
	West North Central			
	South Atlantic	.447		
	East South Central			
	West South Central			
	West	.246		
	Mountain			
	Production Quantity 3X10^3		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	Specific Hazard Data	Processes Which Adequately Treat a Constituent
Picloram														LC50 for mosquito-fish-64 ppm	1) Incineration with alkaline scrubbing
Silvex														48hr LC50 for bluegill-0.60 ppm	2) Carbon sorption
2,3,6-TBA														LD50 for rats-750 mg/Kg body weight	" "
Propanil															" "
															" "

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW volume on waste forms
SIC 2879 Pesticides Chlorinated Aliphatic Herbicide Prod. Wastes DOD Related	New England	.196		
	Mid Atlantic	.062		
	East North Central	.027		
	West North Central			
	South Atlantic	.649		
	East South Central			
	West South Central	.010		
	West			
	Mountain	.057	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity $5X10^3$	Specific Hazard Data	Processes
Dalaphon													▨	96hr LC50 for Bluegill-105 ppm	1) Carbon sorption
Randox	10,000 - 20,000												▨	LD50 for rats-750 mg/Kg body weight	2) Incineration with alkaline scrubbing
Trichloracetic Acid (TCA)													▨	96hr TLm for catfish >2000 ppm	" "
Trichlorobenzyl Chloride	230,000												▨		" "
Aromatic Solvents													▨		" "
													▨		" "
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2879
Pesticides

Chlorinated Hydrocarbon Pesticide Production Wastes

C-1

Ref: EPA. The Pollution Potential in Pesticide Manufacturing. Office of Water Programs, Washington 1972. (Technical Studies Report: TS-00-72-04)

GEOGRAPHIC DISTRIBUTION	
New England	.115
Mid Atlantic	.148
East North Central	.136
West North Central	.073
South Atlantic	.141
East South Central	.057
West South Central	.093
West	.183
Mountain	.054

Production Quantity $2X10^8$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Aldrin		3	2	2	3	3	U	2	U	2	1.0	13	Oral LD_{50} 39-60 mg/Kg Dermal LD_{50} 98 mg/Kg TLV 0.25 mg/m^3	1) Activated carbon bed 2) Potassium Permanganate addition for aldrin removal
Chlordane	100,000	1	2	1	1	3	1	1	3	1	1.0	484	Oral LD_{50} 335-430 mg/Kg Dermal LD_{50} 690-840 mg/Kg TLV 0.5 mg/m^3	3) High temperature incineration with alkaline scrubbing
Dieldrin		3	3	2	3	3	1	3	U	2	1.0	149	Oral LD_{50} 46 mg/Kg Dermal LD_{50} 60-90 mg/Kg TLV 0.25 mg/m^3	" " "
Endrin		3	2	2	3	3	1	3	3	1	1.0	170	Oral LD_{50} 8-18 mg/Kg Dermal LD_{50} 15-18 mg/Kg TLV 0.1 mg/m^3	" " "
Heptachlor	25,000	2	3	2	2	3	1	1	3	1	1.0	496	Oral LD_{50} 100-162 mg/Kg Dermal LD_{50} 195-250 mg/Kg TLV 0.5 mg/m^3	" " "
Lindane													Oral LD_{50} 113-118 mg/Kg Dermal LD_{50} 900-1000 mg/Kg TLV 0.5 mg/m^3	" " "
DDD		1	2	2	2	3	1	1	u	1	1.0	136	Oral LD_{50} 3400 mg/Kg Dermal LD_{50} 24,000 mg/Kg	" " "
DDT	50,000-250,000	3	2	1	2	3	1	3	3	1			Oral LD_{50} 113-118 mg/Kg Dermal LD_{50} 2500 mg/Kg TLV 0.1 mg/m^3	" " "

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2879 TRW #6 P. 47 Pesticides; 2819 Ind.Inorg Chem.; 2869 Ind. Org. Chem. 2822 Syn. Rubbers Contaminated Antimony Trifluoride		AIR			WATER			LAND					New England			Ref: Estimate based on low production
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Mid Atlantic	X		
													East North Central	X		
													West North Central			
													South Atlantic			
													East South Central			
													West South Central	X		
													West			
													Mountain			
	▨											▨	Production Quantity Neg.			
Constituents													▨			
Antimony Trifluoride		3	2	U	3	1	2	2	2	U	1.0	43	▨		TLV for antimony compounds is 0.5 mg/m^3. Lethal dosages as low as 3 grains/24 hrs have been reported. Lethal to fish at concentrations of 100-200 pp	1) None developed, except return to manufacturer for recycle. (Note: Adequately contained during manufacture, so probably very minor amount to be disposed of)

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	C-1	Ref: TRW eight monthly
		AIR			WATER			LAND							
SIC 2879 TRW #6 P. 171 Miscellaneous Organic Pesticide Manufacture Wastes DOD Related		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic .026 East North Central .012 West North Central .002 South Atlantic .257 East South Central West South Central West .702 Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity $3X10^4$		
Constituents													▨		
46-Dinitro-O-Cresol (DNOC)		3	3	3	3	3	1	3	U	3	1.0		▨	Highly toxic to man and animals. TLV in air is 0.2 mg/m^3	1) Adsorption on activated carbon
1,2-Dibromo-3-chloropropane (DBCP)													▨	TL_m for Rainbow Trout is 210.	2) Activated Sludge 3) Eli Lilly patented process ~~4) Light catalysed chlorine~~
Nicotin													▨		oxidation 5) Incineration
Pyrethrins													▨	Forms explosive salts after contact with alkaline materials 48 LC50 for Rainbow Trout-54ppb.	" "
Rotenone													▨	96hr TLm for fathead minnow-.006ppm LD50 for rats-133 mg/kg body weight	" "
Warfarin													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2879
TRW #8 P. 77
Pesticides

from Mercuric Insecticide & Fungicide Manufacture

C-1

GEOGRAPHIC DISTRIBUTION	
New England	.005
Mid Atlantic	.075
East North Central	.145
West North Central	.074
South Atlantic	.299
East South Central	.207
West South Central	.090
West	.058
Mountain	.046

Constituents	Concentration of Constituent in Stream (ppm)	ROOI-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	1.9×10^{12} (all SIC287		
Mercury												257	▨		Recycle - store
Aliphatic Mercury Compounds												258	▨	TLV 0.01 mg/m^3 on skin.	Chlorinate. Reduce with $NaBH_4$ in caustic to elemental mercury
Aromatic Mercury Compounds												258	▨	TLV 0.05 mg/m^3 on skin.	Chlorinate. Reduce with $NaBH_4$ in caustic to elemental mercury
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW volume on waste forms
SIC 2879 TRW #6 P. 185 Pesticides From Manuf. of Halogenated Aliphatic Hydrocarbon Fumigants DOD Related	New England	1.00	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mid Atlantic			
	East North Central			
	West North Central			
	South Atlantic			
	East South Central			
	West South Central			
	West			
	Mountain			
	Production Quantity 2X10^2			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Ethylene Bromide		3	2	2	3	3	1	3	U	2	1.0	182	Highly toxic to man and animals. TLV 190 mg/m^3.	1) Refrigerated condensation 2) Incineration with scrubbing 3) Adsorption on activated carbon
Methyl Bromide		3	2	2	3	1	1	3	3	2	1.25	267	Highly toxic to man and animals. Exposure to 100-500 ppm can lead to chronic poisoning over time. TLV 80 mg/m^3.	" " "
Methyl Chloride		2	U	2	2	1	1	1	U	2	1.5	268	TLV 210 mg/m^3. Dangerous anesthetic and narcotic	" " "

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1
SIC 2879 Pesticide Mfr. Nitrile Pesticide Wastes	New England	.005	
	Mid Atlantic	.075	
	East North Central	.145	
	West North Central	.074	
	South Atlantic	.299	
	East South Central	.207	
	West South Central	.090	
	West	.058	
	Mountain	.046	
	Production Quantity 1.9×10^{12} (all SIC287)		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Isophthalonitrite and													Low order of toxicity	Incinerate
related nitriles	70 to 80%												Low order of toxicity	Incinerate
Organic Solvents	20 to 30%													

C-4

GEOGRAPHIC DISTRIBUTION	
New England	.005
Mid Atlantic	.075
East North Central	.145
West North Central	.074
South Atlantic	.299
East South Central	.207
West South Central	.090
West	.058
Mountain	.046

WASTE STREAM	Concentration of Constituents in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2879 TRW #8 P. 129 Pesticides; 10 Mining; 333 Refining, Non-ferrous Metals Old or Contaminated Thallium, Thallium Sulfate or Rodenticide	▨											▨			
Constituents													▨		
Thallium and Thallium Sulfate		3	3	2	3	U	1	1	2	1	1.0	430 431	▨	TLV 0.1 mg/m^3. Have been used in pesticides and rodenticides	Sealed containers to landfill
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW volume on waste forms
SIC 2879 TRW #4 P. 83 Pesticides Organophosphorous Pesticide Wastes DOD Related	New England	.0007		
	Mid Atlantic	.014		
	East North Central	.010		
	West North Central			
	South Atlantic	.033		
	East South Central			
	West South Central			
	West	.929		
	Mountain	.014	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 1 X10^5	SPECIFIC HAZARD DATA	NDS
Methyl Parathion		3	3	2	3	3	1	3	U	2	1.25	274		Oral LD$_{50}$, 14˜24 mg/kg Dermal LD$_{50}$, 67 mg/Kg; TLV 0.2 mg/m^3	1) Activated carbon bed (for dilute solution) ~~2) Activated sludge (for dilute~~ solution) 3) Alkaline hydrolosis (not for guthion) 4) Incineration (for concentrated wastes)
Parathion	1,000 450,000	3	3	2	3	3	1	3	U	2	1.25	321		Oral LD$_{50}$, 3.6-13 mg/Kg Dermal LD$_{50}$, 6.8-21 mg/Kg; TLV 0.1 mg/m^3	
Demeton		3	3	1	3	3	1	3	3	1	1.0	491		Oral LD$_{50}$, 2.5-6.2 mg/Kg Dermal LD$_{50}$, 8.2-14 mg/Kg; TLV 0.1 mg/m^3	
Guthion		3	3	2	3	3	1	3	3	1	1.0	495		Oral LD$_{50}$, 11-13 mg/Kg Dermal LD$_{50}$, 220 mg/Kg; TLV 0.2 mg/m^3	" "
Mercaptans & Hydrogen Sulfide	50,000	3	3	2	3	3	1	3	2	2	1.5	221			" "
Solvents (Xylene)															" "
Phosphorothioates	20,000 100,000														" "
Malathion	140,000														
Abate															
Tetraethyl Pyrophosphate															

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2879 TRW #8 P. 89 Pesticides from Organophosphate Pesticide Manufacture DOD Related (Continued)	▨											▨	New England .0007 Mid Atlantic .014 East North Central .010 West North Central South Atlantic .033 East South Central West South Central West .929 Mountain .014 Production Quantity $1X10^5$		
Constituents															
Phosphorous Pentasulfide												334	▨	TLV 1.0 mg/m^3 in air. On contact with water decomposes into phosphoric acid and hydrogen sulfide. (TLV 10ppm)	Decompose in water. Scrub to remove hydrogen sulfide.
Phosgene												101	▨	TLV 1 ppm	1) Dilute to 1 ppm 2) Scrub with caustic 3) React with alcohols 4) Hydrolyze at elevated temp. with steam and Na_2CO_3 scrubbing

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2879 TRW #8 P. 11 Pesticides Ansul Chemical Co. & Vineland Chemical Co. Organic Arsenical Herbicide or Defoliating Agents from Manuf. of Cacodylates	New England	-
	Mid Atlantic	.200
	East North Central	.800
	West North Central	
	South Atlantic	
	East South Central	
	West South Central	
	West	
	Mountain	

C-1

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Chloride															
Sodium Sulfate															
Cacodylates	10,000 - 15,000	3	1	2	3	U	1	2	2	2	1.0	80		Highly toxic. TLV 0.5 mg/m^3/8 hr in air	Long-term storage
Cacodylates Dimethylarsenic Acid												80			
(CH$_3$)$_2$ASOOH Cacodylic															
Acid and Sodium Salt															

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC #2879 Pesticides Organic Pesticide Production Wastes	New England	.115
	Mid Atlantic	.148
	East North Central	.136
	West North Central	.073
	South Atlantic	.141
	East South Central	.057
	West South Central	.093
	West	.183
	Mountain	.054

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity $3X10^8$	C-1 SPECIFIC HAZARD DATA (TRW, etc.)	Ref: EPA. The pollution potential of Pesticide Manufacturing Office of Water Programs, Washington, 1972. (Technical Studies Report: TS-00-72-04) PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Pyrethrin														Forms explosive salts after contact with alkaline materials. 48hr LC50 for Rainbow Trout 54ppb	1) Carbon absorption 2) Oxidation 3) Incineration

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: EPA. The pollution potential of Pesticide Manufacturing Office of Water Programs, Washington, 1972. (Technical Studies Report: TS-00-72-04)
SIC #2879 Pesticides Organic Pesticide Production Wastes	New England	.115		
	Mid Atlantic	.148		
	East North Central	.136		
	West North Central	.073		
	South Atlantic	.141		
	East South Central	.057		
	West South Central	.093		
	West	.183		
	Mountain	.054		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TBM Profile Number	Production Quantity 3X10^8	SPECIFIC HAZARD DATA (TBM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Pyrethrin														Forms explosive salts after contact with alkaline materials. 48hr LC50 for Rainbow Trout 54ppb	1) Carbon absorption 2) Oxidation 3) Incineration

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: Environmental Protection Agency. The Pollution Potential in Pesticide Manufacturing. Office of Water Programs, Washington, 1972. (Technical Studies Report: TS-00-72-04)
SIC 2879 Pesticides Organo-Phosphate Pesticide Production Wastes	New England	.115		
	Mid Atlantic	.148		
	East North Central	.136		
	West North Central	.073		
	South Atlantic	.141		
	East South Central	.057		
	West South Central	.093		
	West	.183		
	Mountain	.054	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity 6X10^7			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Specific Hazard Data	Processes Which Adequately Treat a Constituent
Malathion	140,000													1) Activated carbon bed (for dilute solutions) 2) Activated sludge (for dilute solutions) 3) Alkaline hydrolysis (not for guthion) 4) Incineration (for concentrated wastes)
Parathion	1,000-450,000	3	3	2	3	3	1	3	U	2	1.25	321	Oral LD_{50} 3.6-13 mg/Kg Dermal LD_{50}: 6.8-21 mg/Kg TLV 0.1 mg/m^3	
Diazinon														
Demeton		3	3	1	3	3	1	3	3	1	1.0	491	Oral LD_{50}, 2.5-6.2 mg/Kg Dermal LD_{50}, 8.2-14 mg/Kg TLV 0.1 mg/m^3	" " " "
Guthion		3	3	2	3	3	1	3	3	1	1.0	495	Oral LD_{50}, 11-13 mg/Kg Dermal LD_{50}, 220 mg/Kg TLV 0.2 mg/m^3	" " " "
Phosphorothioates	20,000-100,000													" " " "
Methyl Parathion		3	3	2	3	3	1	3	U	2	1.25	274	Oral LD_{50}, 14-24 mg/Kg Dermal LD_{50}, 67 mg/Kg TLV 0.2 mg/m^3	" " " "
Abate														" " " "
TEPP														" " " "

WASTE STREAM

SIC 2879
TSW #5 (V.2)
P. 285
Pesticides

Pesticide Arsenate Wastes

A-5

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	
West	
Mountain	

		BOOZ-ALLEN RATINGS													
		AIR			WATER			LAND							
Constituents	Concentration of Constituent in Stream (ppm)	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	TSW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TSW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT NDS
Calcium Arsenate		3	2	2	3	2	3	2	2	U	1.0	87		TLV 0.5 mg/m^3	1) Recycling and reprocessing 2) Long-term storage
Copper Arsenate												119		"	" "
Lead Arsenate		3	2	2	3	3	1	3	3	1	1.5	235		"	" "
Sodium Arsenate		3	3	2	3	2	1	2	U	1	1.5	376		"	" "
Zinc Arsenate		3	U	2	3	U	1	2	U	1	1.0	453		"	" "
Manganese Arsenate		3	3	2	3	U	1	2	U	1	1.0	500		"	" "

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION		
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating			SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2879 Pesticides Rollins Pesticide Arsenic Wastes (Solid)	▨											▨	New England .005 Mid Atlantic .075 East North Central .145 West North Central .074 South Atlantic .299 East South Central .207 West South Central .090 West .058 Mountain .046 Production Quantity $1.9x10^{12}$ (all SIC287	C-4	NDS
Constituents															
Arsenic salt mixture of sodium sulfate and sodium chloride with arsenic													▨	Toxic in all forms	Long-term storage?
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

A-5

WASTE STREAM

SIC 2879
TRW #6 P.111
Pesticides

From Pesticide Herbicide Manufacture

GEOGRAPHIC DISTRIBUTION	
New England	.005
Mid Atlantic	.075
East North Central	.145
West North Central	.074
South Atlantic	.299
East South Central	.207
West South Central	.090
West	.058
Mountain	.046

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity $1.9x10^{12}$ (all SIC287	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT NDS
Copper Acetoarsenite		3	3	2	3	U	1	2	U	2	1.0	490		TLV 0.5 mg/m^3 Toxic Poison	Safe storage
Sodium and Potassium Arsenite		3	3	2	3	3	1	2	3	1	1.5	377		TLV 0.5 mg/m^3 Toxic Poison	Safe storage
Zinc Arsenite		3	U	2	3	U	1	2	U	1	1.0	454		TLV 0.5 mg/m^3 Toxic Poison	Safe storage
Lead Arsenite		3	3	2	3	U	1	3	U	1	1.2	236		TLV 0.5 mg/m^3 Toxic Poison	Safe storage

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW volume on waste forms
SIC 2879 Pesticides Phenyl-Urea Herbicide Production Wastes DOD Related	New England	.539		
	Mid Atlantic	.059		
	East North Central			
	West North Central			
	South Atlantic	.343		
	East South Central	.059		
	West South Central			
	West			
	Mountain		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 2X10^3		
Diuron														LD$_{50}$ for rats-3400 mg/Kg body weight 48hr LC$_{50}$ for Coho Salmon-16 ppm	1) Carbon sorption 2) Incineration with alkaline scrubbing
Monuron														48hr LC$_{50}$ for mullet-16.3ppm	" "
Linuron														LD$_{50}$ for rats-4000 mg/Kg body weight	" "
Siduron															" "
Chlorouron															" "

WASTE STREAM	GEOGRAPHIC DISTRIBUTION			
SIC 2879 TRW #5 (V. 2) P. 144 Pesticides Polychlorinated Hydrocarbon Pesticide Wastes DOD Related	New England	.097	C-1	Ref: TRW volume on waste forms
	Mid Atlantic	.142		
	East North Central	.018		
	West North Central	.003		
	South Atlantic	.096		
	East South Central	.004		
	West South Central	.033		
	West	.591		
	Mountain	.017	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity $1X10^5$	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				NDS
Aldrin		3	2	2	3	3	U	2	U	2	1.0	13		Oral LD_{50}, 39-60 mg/kg; Dermal LD_{50}, 98 mg/kg, TLV 0.25	1) Activated carbon bed 2) Potassium permanganate addition (for removing aldrin)
Chlordane	100,000	1	2	1	1	3	1	1	3	1	1.0	484		Oral LD_{50}, 335-430; Dermal LD_{50} 690-840 TLV 0.5	3) High temperature incineration with alkaline scrubber
Dieldrin		3	3	2	3	3	1	3	U	2	1.0	149		Oral LD_{50}, 46; Dermal LD_{50}, 60-90 TLV 0.25	" " "
Endrin		3	2	2	3	3	1	3	3	1	1.0	170		Oral LD_{50}, 8-18; Dermal LD_{50}, 15-18 TLV 0.1	" " "
Heptachlor	25,000	2	3	2	2	3	1	1	3	1	1.0	496		Oral LD_{50}, 100-162; Dermal LD_{50}, 195-250 TLV, 0.5	" " "
Methoxychlor	140,000														" " "
Lindane														Oral LD_{50}, 113-118 mg/Kg; Dermal LD_{50}, 900-1000 mg/kg TLV, 0.5 mg/m^3	1) Activated Carbon 2) High temperature incineration with alkaline scrubbing
DDD		1	2	2	2	3	1	1	U	1	1.0	136		Oral LD_{50}, 3400; Dermal LD <4000 mg/Kg	" " "
DDT	50,000 250,000	3	2	1	2	3	1	3	3	1	1.25	137		Oral LD_{50}, 113-118 mg/Kg; Dermal LD_{50}, 2500 mg/Kg TLV 0.1 mg/m^3	" " "
Solvent (benzene, xylene, toluene															

WASTE STREAM
SIC 2879 TRW #5 (V. 2) P. 144 Pesticides Polychlorinated Hydrocarbon Pesticide Wastes DOD Related Page 2

GEOGRAPHIC DISTRIBUTION	
New England	.097
Mid Atlantic	.142
East North Central	.018
West North Central	.003
South Atlantic	.096
East South Central	.004
West South Central	.033
West	.591
Mountain	.017

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human			WATER Human			LAND Human			Production Rating	TRW Profile Number	Production Quantity 1X10^5	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion		▨			NDS
Phosgene												101	▨	TLV 1 ppm	1) Dilute to 1 ppm 2) Scrub with caustic 3) React with alcohols 4) Hydrolyze at elevated temp. with steam and Na_2CO_3 scrubbing
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2879 Pesticides 1080 Production Wastes	New England		A-5	Ref: Estimate based on low production
	Mid Atlantic	*		
	East North Central			
	West North Central			
	South Atlantic	*		
	East South Central	1.0		
	West South Central			
	West			
	Mountain			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Neg.	*Production of sodium fluoracetate	
Sodium Fluoro-acetate													▨	Highly toxic to mammals	
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW volume on waste forms
SIC 2879 Pesticide Manufacture Production Wastes and Residue Phenoxy Herbicides DOD Related Production Wastes and Cleanup	New England	.0002		
	Mid Atlantic	.0001		
	East North Central	.0007		
	West North Central			
	South Atlantic	.0008		
	East South Central	.849		
	West South Central	.149		
	West	.0004		
	Mountain	.0002	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 8X10^6	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
*2,4-D	20 to 25%											135	▨	Moderately toxic to mammals. Inhalation of 2,4-D dusts and sprays is relatively harmless	1) Adsorption with activated carbon 2) Biological treatment 3) Ion exchange
													▨	TLV in air is 10 mg/m^3. Attacks broadleafs.	4) Incineration of concentrated Wastes
2,6-D	20 to 25%												▨		
Mono & Trichloro Phenoxy Acetic Acids	10 to 15%												▨		
Solvents	Bal.												▨		
Water													▨		
2,4,5-T													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-6	Ref: TRW volume on waste forms
SIC 2879 Herbicides Benzoic Herbicide Contaminated Containers	New England			
	Mid Atlantic			
	East North Central	.655		
	West North Central	.154		
	South Atlantic	.006		
	East South Central	.017		
	West South Central			
	West	.160		
	Mountain	.009	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 2X10^4	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Benzoic Herbicides															Combustible packages can be incinerated employing mineral oil binders

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-4	Ref: TRW volume on waste forms
SIC 2879 Pesticides SIC 01,02, 07 Agriculture SIC 08 Forestry SIC 40,41,42,44, 45 Transportation Calcium Arsenate Contaminated Containers	New England	.03		
	Mid Atlantic	.02		
	East North Central	.08		
	West North Central	.07		
	South Atlantic	.16		
	East South Central	.16		
	West South Central	.35		
	West	.03		
	Mountain	.09		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 6X10^3	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Calcium Arsenate		3	2	2	3	3	2	2	U	2	1.0	87		TLV 0.5 mg/m^3	1) Recycle and reprocess after solvent cleaning 2) Long-term storage

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	C-6	Ref: TRW volume on waste forms
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating			SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2879 Pesticides SIC 01,02,07 Agriculture SIC 08 Forestry SIC 40,41,42,44,45 Transportation Carbonate Contaminated Containers	▨											▨	New England .0008 Mid Atlantic .016 East North Central .382 West North Central .070 South Atlantic .022 East South Central .108 West South Central .321 West .060 Mountain .020		
Constituents													Production Quantity 5X10^4		
													▨		
Carbonate Herbicides													▨		Combustible packages can be incinerated using mineral oil binders
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

Chlorinated Aliphatic Contaminated Containers

GEOGRAPHIC DISTRIBUTION	
New England	.381
Mid Atlantic	
East North Central	.076
West North Central	.418
South Atlantic	
East South Central	.105
West South Central	.010
West	.010
Mountain	

Production Quantity $1X10^4$

C-6

SPECIFIC HAZARD DATA (TRW, etc.)

Ref: TRW volume on waste forms

PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chlorinated Aliphatic Herbicides															Combustible packages can be incinerated using mineral oil binders

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Dinitro Contaminated Containers	▨											▨	New England .496 Mid Atlantic .068 East North Central .023 West North Central .017 South Atlantic .228 East South Central West South Central .003 West .165 Mountain .006 Production Quantity 2X10^4	C-6	Ref: TRW volume on waste forms
Constituents															
Dinitro Herbicides													▨		Combustible packages can be incinerated using mineral oil binders
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-4	Ref: TRW volume on waste forms
Lead Arsenate Contaminated Containers	New England	.03		
	Mid Atlantic	.02		
	East North Central	.08		
	West North Central	.07		
	South Atlantic	.17		
	East South Central	.17		
	West South Central	.35		
	West	.08		
	Mountain	.03	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity $1X10^4$		
Lead Arsenate		3	2	2	3	3	1	3	3	3	11.5			TLV 0.5 mg/m^3	1) Recycle and reprocess after Solvent cleaning 2) Long term storage

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Mercury Contaminated Fungicide Containers	New England	.02	C-4	Ref: TRW volume on waste forms
	Mid Atlantic	.03		
	East North Central	.04		
	West North Central	.03		
	South Atlantic	.28		
	East South Central	.32		
	West South Central	.05		
	West	.22		
	Mountain	.01		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	Specific Hazard Data	Processes Which Adequately Treat a Constituent
	▨											▨	Production Quantity 5X10^2		
													▨		
Mercury Fungicides		3	3	2	3	3	1	3U		1	1.0		▨		Solvent extract fungicide
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND								
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating					
Misc. Organic Contaminated Containers													New England	.014	C-6	Ref: TRW volume on waste forms
													Mid Atlantic	.162		
													East North Central	.385		
													West North Central	.068		
													South Atlantic	.162		
													East South Central	.123		
													West South Central	.041		
													West	.034		
													Mountain	.014		
	▨											▨	Production Quantity $1X10^4$			

Constituents															
Misc. Org. Herbicides													▨		Combustible packages can be incinerated using mineral oil binders
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION		C-6	Ref: TRW volume on waste forms
		AIR			WATER			LAND								
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating					
Misc. Organic Insecticide Contaminated Containers													New England	.148		
													Mid Atlantic	.084		
													East North Central	.054		
													West North Central	.039		
													South Atlantic	.197		
													East South Central	.143		
													West South Central	.148		
													West	.170		
													Mountain	.017	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity $4X10^4$			
Constituents													▨			
Misc. Organic Insecticides													▨			Combustible packages can be incinerated using mineral oil binders
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Organic Arsenical Contaminated Containers													New England		C-6	Ref: TRW volume on waste forms
													Mid Atlantic	.007		
													East North Central			
													West North Central			
													South Atlantic	.011		
													East South Central	.764		
													West South Central	.218		
													West			
													Mountain			
	▨											▨	Production Quantity 5X10^3			
Constituents																
Organic Arsenical Herbicides													▨			Combustible packages can be incinerated using mineral oi binders
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			

WASTE STREAM

Organic Fungicide Contaminated Containers

C-6

Ref: TRW volume on waste forms

GEOGRAPHIC DISTRIBUTION	
New England	.048
Mid Atlantic	.125
East North Central	.047
West North Central	.028
South Atlantic	.441
East South Central	.001
West South Central	.036
West	.266
Mountain	.007

Production Quantity $8X10^4$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
Organic Fungicides													▨		Combustible packages can be incinerated using mineral oil binders
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

Organophosphorous Contaminated Containers

C-6

Ref: TRW volume on waste forms

GEOGRAPHIC DISTRIBUTION	
New England	.043
Mid Atlantic	.050
East North Central	.018
West North Central	.125
South Atlantic	.139
East South Central	.192
West South Central	.175
West	.208
Mountain	.049

Production Quantity 1X10^5

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Organophosphorous Insecticides														Hydrolysis with ethanal and caustic. Reuse of container. Combustible packages can be incinerated using mineral oil binders.

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phenoxy Contaminated Containers													New England	.035	C-6	Ref: TRW volume on waste forms
													Mid Atlantic	.033		
													East North Central	.196		
													West North Central	.321		
													South Atlantic	.031		
													East South Central	.030		
													West South Central	.067		
													West	.146		
													Mountain	.141		
													Production Quantity 2X10^5			
Constituents																
Phenoxy Herbicides																Combustible packages can be incinerated using mineral oil binders

WASTE STREAM

Phenyl-Urea-Contaminated Container

C-6

Ref: TRW volume on waste forms

GEOGRAPHIC DISTRIBUTION	
New England	.106
Mid Atlantic	.085
East North Central	.106
West North Central	.033
South Atlantic	.106
East South Central	.424
West South Central	.042
West	.095
Mountain	.003

Production Quantity
9X10^3

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phenyl-Urea Herbicides														Combustible packages can be incinerated using mineral oil binders

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION		C-6	Ref: TRW volume on waste forms
		AIR			WATER			LAND								
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating					
Polychlorinated Hydrocarbon on Contaminated Containers													New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	.017 .107 .019 .138 .306 .211 .133 .044 .024	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity $2X10^5$			
Constituents													▨			
Polychlorinated Hydrocarbon Insecticides													▨			Combustible packages can be incinerated using mineral oil binders
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			
													▨			

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-6	Ref: TRW volume on waste forms
Triazine Contaminated Containers	New England	.147		
	Mid Atlantic	.121		
	East North Central	.320		
	West North Central	.372		
	South Atlantic	.013		
	East South Central	.003		
	West South Central	.011		
	West	.011		
	Mountain	.002	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY THREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY THREAT A CONSTITUENT
	▨											▨	6X10^4		
													▨		
Triazine Herbicides													▨		Combustible packages can be incinerated using mineral oil binders
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2879 Pesticide Pesticides Torpedo Process Waste	New England		A-6	Ref: Estimate based on low production
	Mid Atlantic			
	East North Central			
	West North Central			
	South Atlantic			
	East South Central	1.00		
	West South Central			
	West			
	Mountain			
	Production Quantity	Neg.		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Torpedo (Dichloroethyl-dinitro Toluidene)	77%												Data unavailable	
Nitric Acid	38%	3	3	1	3	3	2	3	2	1	1.5			Neutralization
Phosphoric Acid	18%	2	U	2	2	3	1	2	U	1	1.5			Neutralization
Hydrochloric Acid	14%	3	1	2	3	3	1	3	U	2	1.5			Neutralization
Water	23%													

WASTE STREAM

SIC 2879
Pesticides

Wastes from Production of Miscellaneous Organic Herbicides

GEOGRAPHIC DISTRIBUTION	
New England	.076
Mid Atlantic	.135
East North Central	.124
West North Central	.080
South Atlantic	.156
East South Central	.062
West South Central	.108
West	.200
Mountain	.059

C-1

Ref: EPA. The pollution potential in Pesticide Manufacturing Office of Water Programs, Washington, 1972. (Technical Studies Report: TS-00-72-04)

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 4X10^8	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Diuron														LD50 for rats-3400 mg/Kg 48hr LC50 for Coho Salmon -16ppm	1) Activated carbon adsorption 2) High temperature incineration
Monuron														48hr LC50 for mullet-16.3 ppm	• •
Linuron														LD50 for rats-4000 mg/Kg	• •
Siduron															• •
Chlororuron															• •
Benzoic Derivatives															• •

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: EPA. The Pollution Potential in Pesticide Manufacturing. Office of Water Programs. Washington, 1972. (Technical Studies Report: TS-00-72-04)
SIC 2879 Pesticides Wastes from Production of Phenoxy Herbicides	New England	.076		
	Mid Atlantic	.135		
	East North Central	.124		
	West North Central	.080		
	South Atlantic	.156		
	East South Central	.062		
	West South Central	.108		
	West	.200		
	Mountain	.059		

Constituents	Concentration of Constituents in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 4X10^7	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
2,4-D	20 - 25%											135	▨	Moderately toxic to mammals. Inhalation of 2,4-D dusts and sprays is relatively harmless. TLV 10 mg/m . Attacks Broadleafs.	1) Adsorption with activated carbon 2) Biological treatment 3) Ion exchange 4) Incineration of concentrated wastes.
													▨		
2,6-D	20 - 25%												▨		
Mono & Trichloro Phenoxy Acetic Acids	10 - 15%												▨		
													▨		
2,4,5-T													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2892
Explosives

High Explosive
Contaminated
Solid Wastes

GEOGRAPHIC DISTRIBUTION	
New England	-
Mid Atlantic	.005
East North Central	.094
West North Central	.394
South Atlantic	.397
East South Central	.027
West South Central	.009
West	.012
Mountain	.023

C-5

Ref: TRW Final Report
from DOD statistics

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	 Ecological	 Explosion	 WATER Human	 Ecological	 Explosion	 LAND Human	 Ecological	 Explosion	Production Rating	TRW Profile Number	Production Quantity 1X10	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
TNT															
HMX															
TDX															
PETN		2	U	3	2	U	1	2	U	3	1.0				
TETRYL															
RDX															

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	
SIC 2892 TRW #8 P. 145 SIC Explosives Manuf. Primary Explosives Contaminated Waste	New England		See other sheet on Primary Explosive Wastes	Ref: TRW volume on waste forms
	Mid Atlantic	.096		
	East North Central	.001		
	West North Central	.898		
	South Atlantic	-		
	East South Central	.001		
	West South Central	-		
	West	.001		
	Mountain	.003	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 4X10^6	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
(DDNP) Diazodinitrophenol												521		Unknown toxicity. Very sensitive primary explosive	Controlled incineration with scrubbing.
(DPEHN) Dipentacrythritol hexanitrate												522		TLV not established. Very sensitive primary explosive	1) Controlled incineration. 2) Decomposition in boiling Ferrous Chloride
Lead Azide (dextrinated)												529		TLV 0.2 mg/m^3 in air. Very sensitive primary explosive	1) Treat with caustic 2) Treat with nitrite 3) Treat with ceric ammonium nitrate 4) Electrolytic destruction 5) Controlled incineration
Lead Styphnate (2,4,6-trinitro resorcinate)												531		TLV 0.2 mg/m^3. Very sensitive primary explosive	1) React with Na_2CO_3 2) Controlled incineration
Mixtures of Lead Azide & Lead Styphnate												529 531		TLV 0.2 mg/m^3. Very sensitive primary explosive	Controlled incineration
Mannitol Hexanitrate												532		TLV not established. Very sensitive secondary (booster) explosive	- Detonation or open burning. Newer methods under development.
Mercury Fulminate												533		TLV 0.1 mg/m^3; Toxic poison. Very sensitive primary explosive	Treat with Thiosulfate-precipitate HgS. Recycle Hg
Potassium dinitro benzfuroxan (KDNBF)												536		TLV not established. Sensitive primary explosive	Controlled incineration

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2892 TRW #8 P. 145 Explosives (Continued)	▨											▨	New England	-	See other sheet on Primary Explosive Wastes	
													Mid Atlantic	.096		
													East North Central	.001		
													West North Central	.898		
													South Atlantic	-		
													East South Central	.001		
													West South Central	-		
													West	.007		
													Mountain	.003		
													Production Quantity $4X10^6$			
Constituents													▨			
Silver Azide (not presently manuf. in USA)												538	▨		TLV not established. Sensitive primary explosive.	Treat with nitrite, recover silver by electrolysis, and neutralize solution
Tetrazene												542	▨		Toxicity unknown. Sensitive primary explosive	Decompose by passing steam into H_2O containing Tetrazene crystals
Sodium Azide												378	▨		High toxicity. LD_{50} for rats is 46 mg/Kg. Moderate explosive hazard, but if combined with other heavy metals in solution, very sensitive compounds can be precipitated	1) Chemical decomposition with scrubbing 2) Incineration with scrubbin
													▨			
													▨			
													▨			
-													▨			
													▨			
													▨			

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-5	Ref : TRW final report from DOD statistics
SIC 2892 Explosives Nitrocellulose Base Propellant Contaminated Solid Waste	New England	-		
	Mid Atlantic	.041		
	East North Central	-		
	West North Central	.457		
	South Atlantic	.492		
	East South Central	-		
	West South Central	-		
	West	-		
	Mountain	.009	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity $9X10^6$			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead and Mononitro-resorsinate															Under development
Nitrocellulose Alcohols												534			
Nitrocellulose Acetates												534			

WASTE STREAM

SIC 2892
Explosives

Nitroglycerin
Contaminated
Solid Wastes

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	.42
East South Central	.19
West South Central	
West	.39
Mountain	

A-6

Ref: TRW volume on waste forms

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
													7X10^5		Not recommended for transport to NDS due to risk.
Sulfuric Acid	5100#/ 100000# of Prod	3	2	2	3	3	2	3	U	2	1.5				Neutralize
Nitric Acid	5740#/ 100000# of Prod	3	3	1	3	3	2	3	2	1	1.5				Neutralize
Nitroglycerin		3	3	3	3	U	1	2	U	3	1.0	307		TLV 0.2 ppm. Explosive-mechanical shock or at 150-160°C	Incineration

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-5	Ref: Final Report TRW Systems Group, Inc.
SIC 2892 Explosives SIC 2899 Misc. Chemicals and Chemical Preps. Nitrocellulose Propellant and Smokeless Powder Manuf. Wastes	New England	-		
	Mid Atlantic	.060		
	East North Central	.046		
	West North Central	.387		
	South Atlantic	.477		
	East South Central	-		
	West South Central	.066		
	West	-		
	Mountain	.025	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity 6X10^6			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead and Mononitroresorsinate	4% Slurry													Under development
nitrocellulose alcohols												534		
nitrocellulose acetates												534		
Sulfuric Acid	1# # Prod.	3	2	2	3	2	3	3	2	U	1.5			Neutralize
Nitric Acid	1# # Prod.	3	1	3	3	2	3	3	1	2	1.5			Neutralize

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW final report
SIC 2892 TRW #8 P. 145 Explosives Old Primers and Detonators - Solid Waste Primary Explosives	New England	-		
	Mid Atlantic	.005		
	East North Central	.430		
	West North Central	.454		
	South Atlantic	.001		
	East South Central	.006		
	West South Central	-		
	West	.084		
	Mountain	.014	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 3X10	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
(DDNP) Diazodinitrophenol												521		Unknown toxicity. Very sensitive primary explosive	Controlled incineration with scrubbing.
DPEHN Dipentacrythritol-hexanitrate												522		TLV not established. Very sensitive primary explosive	Controlled incineration. Decomposition in boiling ferrou chloride
Lead Azide (dextrinated)												529		TLV 0.2 mg/m^3 in air (recommended). Very sensitive primary explosive. Avoid.	1) Treat with caustic 2) Trea with nitrite 3) Treat with ceric ammonium nitrate
															4) Electrolytic destruction 5) Controlled incineration
Lead Styphnate (2,4,6-Trinitro-resorcinate)												531		TLV 0.2 mg/m^3. Very sensitive primary explosive	1) React with Na_2CO_3 2) Controlled incineration
Mixtures of Lead Azide and Lead Styphnate												529 531		TLV 0.2 mg/m^3. Very sensitive primary explosive	Controlled incineration
Mannitol Hexanitrate												532		TLV not established. Very sensitive secondary (booster) explosive.	Detonation or open burning, Newer methods under development
Mercury Fulminate												533		Poison. Very sensitive primary explosive. TLV 0.1 mg/m^3	Treat with Thiosulfate-precipitate HgS. Recycle mercury
Potassium Dinitro Benzfuroxan (KDNBF)												536		TLV not established. Sensitive primary explosive	Controlled incineration

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND								
SIC 2892 TRW #8 P. 145 Explosives (Continued)		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	- .005 .430 .454 .001 .006 - .084 .014		
													Production Quantity $3X10^5$			
Constituents																
Silver Azide (not presently manuf. in USA)												538			TLV not established, sensitive primary explosive	Treat with Nitrite, recover silver by electrolysis and neutralize solution
Tetrazene												542			Toxicity N.A. Sensitive primary explosive	Decompose by passing steam into water containing tetrazene crystals

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-5	Ref: TRW final report
SIC 2892 Explosives Pyrotechnic and Incindiary Contaminated Wastes	New England	-		
	Mid Atlantic	-		
	East North Central	-		
	West North Central	-		
	South Atlantic	-		
	East South Central	-		
	West South Central	1.0		
	West	-		
	Mountain	-	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity 6X10			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phosphorous		3	U	3	3	3	3	3	U	3	1.5	332			
Tungsten															
Barium Chromate															

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW final report
SIC 2892 Explosives Waste High Explosives	New England	.002		
	Mid Atlantic	.006		
	East North Central	.346		
	West North Central	.174		
	South Atlantic	.218		
	East South Central	.104		
	West South Central	.127		
	West	.001		
	Mountain	.010		
	Production Quantity 1X10		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity	Specific Hazard Data	Processes
		AIR			WATER			LAND							
Constituents		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
TNT														Readily explosive	
HMX														" "	
TD														" "	
PETN		2	U	3	2	U	1	2	U	3	1.0			" "	
TETRYL														" "	
RDX														" "	

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW final report
SIC 2892 Explosives SIC 2899 Misc. Chemical Products Waste Nitrocellulose and Smokeless Powder	New England	-		
	Mid Atlantic	-		
	East North Central	-		
	West North Central	-		
	South Atlantic	-		
	East South Central	-		
	West South Central	-		
	West	.594		
	Mountain	.406	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity $2X10^6$			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Nitrocellulose												534		Flammable and reactive hazard, flash point 55°F	

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TBW Profile Number
		AIR			WATER			LAND				
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	
SIC 2892 Explosives Waste Nitro-glycerin	▨	3	3	3	3	U	1	2	U	3	1.0	▨
Constituents												

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	
East North Central	.01
West North Central	
South Atlantic	.50
East South Central	.22
West South Central	
West	.266
Mountain	.004
Production Quantity $5X10^5$	

SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
C-1	Ref: Volume on explosives
TLV 0.2 ppm. Explosive at mech. shock or 150-160°C	Incineration or Detonation

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-5	Ref: TRW Final Report
SIC 2892 Explosives Waste Pyro-technics and Incindiaries	New England	-		
	Mid Atlantic	.014		
	East North Central	.002		
	West North Central	.002		
	South Atlantic	-		
	East South Central	-		
	West South Central	.718		
	West	.255		
	Mountain	.009		
	Production Quantity $8X10^3$			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND						
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating			
Powdered Metals														
Phosphorous		3	U	3	3	3	3	3	U	3	1.5	332		
Tungsten														
Potassium Perchlorate														
Barium Chromate														
Lead Chromate														

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: TRW Final Report
SIC 2892 TRW #8 P. 165 Explosives SIC 2899 Misc. Chemical From Solid Propellant Manuf. Propellant Contaminated Waste and Ind. Propellant Explosive Waste	New England	-		
	Mid Atlantic	-		
	East North Central	-		
	West North Central	-		
	South Atlantic	-		
	East South Central	-		
	West South Central	-		
	West	.655		
	Mountain	.345	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 3X10^3	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Gelatinized (PNC) Nitrocellulose												523		Solvent from manuf. may be toxic. Extreme fire hazard	Controlled incineration with scrubbing
Smokeless Powder												541			
Single Base															
Multiple Base															

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2899 TRW #8 P. 133 Miscellaneous Chem.Products From the Manufacture of Electrical "Match Head Type" Fuses													New England .037 Mid Atlantic .221 East North Central .372 West North Central .153 South Atlantic .039 East South Central .040 West South Central .057 West .072 Mountain .009	C-6	
	▨											▨	Production Quantity $1.6x10^{12}$ (all SIC289		
Constituents													▨		
Cuprous Acetylide												517	▨	Toxicity not well established. Very sensitive primary explosive	Detonation only procedure presently available
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	
SIC 291 Petroleum Refining Copper and Lead Bearing Waste	

GEOGRAPHIC DISTRIBUTION	
New England	.001
Mid Atlantic	.102
East North Central	.175
West North Central	.056
South Atlantic	.019
East South Central	.031
West South Central	.417
West	.160
Mountain	.039

A-6

Ref: BNW estimate of light oil refining waste volumes, these wastes are easily reduced to sludges with spent caustic streams according to Roy Weston, Inc. in "Guidelines for Petroleum Refining Effluents," Vol. arriving at NDS expected to be smaller a a C-4 sludge.

Production Quantity $8X10^8$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TBM Profile Number	SPECIFIC HAZARD DATA (TBM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead Cyanides		3	2	2	3	U	2	3	3	2	1.2	239	TLV 5 mg/m^3	Chlorination
Lead Nitrates		3	2	3	3	3	1	3	3	3	1.2	240	TLV 0.15 ppm Cumulative poison	Add ammonium carbonate, settl and filter out lead carbonate. Landfill or recycle.
Copper Nitrate		2	3	3	2	3	1	1	U	2	1	121		
Copper Cyanide		2	U	2	2	U	2	1	U	2	1	120	TLV 5 mg/m^3	Chlorination

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		WASTE STREAM Continued
SIC 2911 TRW #6 P. 205 Pet. Ref.-Jet Fuels; 9711 Nat. Sec.;2869 Ind. Org. Chem. Jet and Rocket Fuel Storage and Use Wastes	New England	X	From the Manufacture of Hydrazine A-5
	Mid Atlantic	X	
	East North Central		
	West North Central		
	South Atlantic	X	
	East South Central		
	West South Central		X
	West		
	Mountain		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
													▨		
Hydrazine		3	3	2	3	1	3	3	3U		1.0	212	▨	TLV 1.3 mg/m^3. Strong irritant. Flammable and hypergolic with some oxidants	1) Incineration 2) Catalytic decomposition 3) Dilute with water and allow bacterial decomposition
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	C-4 SPECIFIC HAZARD DATA (TRW, etc.)	Ref: TRW volume on waste forms PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2911 Petroleum Refining Still Bottoms (Stored)	▨											▨	New England .006 Mid Atlantic .086 East North Central .159 West North Central .055 South Atlantic .025 East South Central .025 West South Central .477 West .134 Mountain .033		
Constituents													Production Quantity 2X10^4		Aerojet General
													▨		
Arsenic Trichloride		3	3	3	3	3	1	2	3	2	1.0	50	▨	TLV 0.5 mg/m^3	Recycle and reprocess
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-5	Ref: TRW volume on waste forms
SIC 2911 Petroleum Refining Waste Brine Sludges	New England	.002		
	Mid Atlantic	.06		
	East North Central	.09		
	West North Central	.011		
	South Atlantic	.12		
	East South Central	.10		
	West South Central	.55		
	West	.045		
	Mountain	.022	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity 4X10⁶			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead Salts		3	2	2	3	U	1	3	U	1	1.25	233		
Mercury Salts		3	3	2	3	3	1	3	U	2	1.0	257	Bioaccumulative and toxic when methylated	

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2911 Petroleum Refining TRW #6 P. 249 Wastes from Gasoline Blending Operations	New England	.006	C-1	Ref: 20 lbs waste/bbl-Roy Weston-"Guidelines for Petroleum Refining Effluents for EPA" - 2 X 10^9 bbls automobile gasoline 1968: "State, Abstract of U.S.-assume 1% lead bearing concentrates and sludges
	Mid Atlantic	.086		
	East North Central	.159		
	West North Central	.055		
	South Atlantic	.025		
	East South Central	.025		
	West South Central	.477		
	West	.134		
	Mountain	.033		
	Production Quantity 4X10^8			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS: AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Specific Hazard Data	Processes Which Adequately Treat a Constituent
Tetramethyl Lead		3	2	2	3	1	1	3	3	2	1.25	427	Extremely toxic. TLV, 0.075 mg/m^3. Fire hazard when exposed to heat and flame.	1) Incineration and scrubbing 2) Ion exchange
Tetraethyl Lead		3	3	2	3	3	1	3	3	2	1.5	425	" " "	" "
Gasoline														

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref:
SIC 2992 Lubricating Oils and Greases Reclaimers Residues	New England	.040		1.25 X 10^9 gal drained/yr - "Conversion of Crankcase Waste Oil into Useful Products" Nat. Oil Recovery Corp. 15080 BO 03/71, 25% is residue according to Harold Bernard, R&M EPA
	Mid Atlantic	.120		
	East North Central	.205		
	West North Central	.081		
	South Atlantic	.135		
	East South Central	.082		
	West South Central	.139		
	West	.155		
	Mountain	.044		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TEM Profile Number	Production Quantity 3X10^8	SPECIFIC HAZARD DATA (TLV, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead Oxide	15,000	3	2	2	3	U	1	3	U	2	1.25	242	▨		Conc. & ppt.
Tetraethyl Lead		3	3	2	3	3	1	3	3	2	1.5	425	▨	Extremely toxic. TLV 0.075 mg/m^3. Fire hazard when exposed to heat or flame	1) Incineration with scrubbing 2) Ion exchange
Cadmium	<10											81	▨		Controlled storage
Tin													▨		
Antimony												33	▨		
Arsenic	<50											46	▨		Conc. and stores (Poss. shipment to reprocessing site)
Chromium	16	3	2	2	3	3	1	3	U	2	1.25	113	▨	TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water	Ion exchange, activated carbon, or chemical reduction and ppt
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOS-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 3011 Tires and Tubes;3021 Footwear;3031 Reclaimed Rubber;3041 Hoses and Belting; 3069 Misc. Rubber;2822 Syn. Rubber Rubber Mfg. Wastes-Retained Sludge	▨											▨	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	 .07 .14 .11 .11 .50 .07 	C-1	Ref: Estimate of PCB use - 1971 $3X10^6$ lbs used for heat transfer type applications - CUM-72-10419 Interdepartmental Task force on PCB's May 1972, - Take 1/3 for rubber manufacturer
Constituents													Production Quantity $1X10^6$			
													▨			
Polychlorinated Biphenyls	50,000 990,000	3	U	2	2	U	1	2	U	1	1.0	507	▨		TLV 0.5-1.0 mg/m^3	High temperature incineration and alkaline scrubbing
Diphenyl													▨			
Diphenyl Oxide													▨			
Aldehydes	27.7	2	3	2	2	3	1	2	2	2	1.5		▨			
Styrene	109	2	1	2	2	3	1	2	U	1	1.5		▨			
Nekal	437												▨			
Selenium Diethyldithiocarbamate (Butyl Rubber)													▨			(Used for vulcanization)
													▨			
													▨			

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		B-2	
SIC 31 Leather and Leather Products Leather Tanning and Finishing Chrome Tan Liquor	New England	.22	SPECIFIC HAZARD DATA (TBW, etc.)	Ref: Booz-Allen Table III-6 as dry weight chromium and sulfides PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mid Atlantic	.29		
	East North Central	.29		
	West North Central	.03		
	South Atlantic	.086		
	East South Central	.05		
	West South Central	.004		
	West	.03		
	Mountain			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TBW Profile Number	Production Quantity	Specific Hazard Data	Processes Which Adequately Treat a Constituent
	▨											▨	2X10^7		NDS
Sodium Chromate 357	11-3226	3	3	1	3	2	1	3	U	1	1.5	386	▨	TLV .1 mg/m^3	1) Red.-precipitation 2) Electro Reduction
													▨		
Sodium Sulfide 373	1,000	1	3	2	3	3	2	2	U	3	1.5		▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-5	Ref: Booz-Allen Table III-6 - chromium and iron on dry weight basis
SIC 3231 Glass Products Mirror Production Wastes	New England	.09		
	Mid Atlantic	.25		
	East North Central	.23		
	West North Central	.01		
	South Atlantic	.28		
	East South Central	.10		
	West South Central	.04		
	West		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mountain			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 9X10^6 lbs	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chromic Sulfate	.019# / 1000 ft^2 Prod.	3	2	2	3	3	1	3	3	1	1	486		TLV 0.5 mg/m^3	1) Ion exchange 2) Sewer 3) Precip.
Ferrous Sulfate	.069# / 1000 ft^2 Prod.	1	2	1	1	3	1	1	U	1	1.5				

WASTE STREAM

SIC 33 Primary Metal Ind.
SIC 331 Blast Furnaces Steel Works, Rolling and Finishing Mills

Consolidated Steel Plant Wastes Sludge

GEOGRAPHIC DISTRIBUTION	
New England	.02
Mid Atlantic	.33
East North Central	.42
West North Central	.02
South Atlantic	.09
East South Central	.02
West South Central	.03
West	.02
Mountain	.05

A-5

Ref: Booz-Allen Table III-6 listed as dry weight basis

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
													$5X10^6$		
Phenols	824# M$VA	3	2	2	3	3	1	3	U	2	1.5				
Sodium Cyanide	365# M$VA	3	3	2	3	3	2	2	U	2	1.5	387		TLV 5 mg/m^3	Alkaline oxidation
Sodium Fluorides	397# M$VA	3	3	2	3	3	1	3	2	1	1.25	389		TLV 2.5 mg/m^3 dusts, 0.8-1.7 mg/l max. for drinking water. 2.4 mg/l for livestock	Continuous liming with landfill of resulting CaF2
Ammonia	997 M$VA	2	U	2	3	3	1	2	U	2	1.5		Breakdown by lbs. available		
Sulfuric Acid	414 M$VA	3	2	2	3	3	2	3	U	2	1.5				Neutralize
Chromic Sulfate	556 M$VA	3	2	2	3	3	1	3	3	1	1	486		TLV 0.5 mg/m^3	1) Ion exchange 2) Discharge to municipal sewer
															3) Direct ppt.
Zinc Chloride	172 M$VA	2	3	2	1	3	1	2	U	2	1.25				Conc. & ppt.
Hydrochloric Acid	1.71 M$VA	3	1	2	3	3	1	3	U	2	1.5				Neutralize

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRN Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRN, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND								
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	2.2 gal/ton Production Rating					
SIC 33 Cont. 331 Iron Manufacture Iron Manufacturing Wastes Sludge	▨											▨	New England	.05	C-2	Ref: Booz-Allen Table III-6 listed as dry weight of Cyanide
													Mid Atlantic	.05		
													East North Central	.56		
													West North Central	.02		
													South Atlantic	.12		
													East South Central	.03		
													West South Central	.09		
													West	.03		
													Mountain	.05		
													Production Quantity 6X10^6			
Constituents																
Phenol	.02# ton prod.	3	2	2	3	3	1	3	U	2	1.5		▨			
Ammonia	0.25# ton	2	U	2	3	3	1	2	U	2	1.5		Add prod. data available			
Sodium Cyanide	0.09# ton	3	3	2	3	3	2	2	U	2	1.5	387	▨		TLV 5 mg/m^3	Alkaline oxidation by chlorination

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: Booz-Allen Table III-6 listed as dry weight basis
SIC 3312 Coke Plant Coke Plant Raw Waste Sludge	New England	.02		
	Mid Atlantic	.33		
	East North Central	.41		
	West North Central	.01		
	South Atlantic	.07		
	East South Central	.02		
	West South Central	.06		
	West	.02		
	Mountain	.06	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TBW Profile Number	Production Quantity 8X10^7	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phenol	150-3,000	3	2	2	3	3	1	3	U	2	1.5	327			
Sodium Cyanide	60	3	3	2	3	3	2	2	U	2	1.5	387	Add prod. data available	TLV 5 mg/m^3	Alkaline oxidation
Ammonia 19	300-10,000	2	U	2	3	3	1	2	U	2	1.5				
Tar Acids	25-1,400														
Thiocyanate	80-1,300	1	2	2	3	1	3	1	1	U	1.5				
Thiosulfate	20-1,300														
Nitrogen Bases as Pyridine	100														
Hydrogen Cyanide		3	3	3	3	3	2	3	U	3	1.5	218		TLV 11 mg/m^3 Protoplasmic poison. Can be explosive, hydrocyanic acid is especially toxic.	1) Incineration with NO_x scrubbing 2) Scrub with potassium or sodium salts to form cyanide salts

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-6	Ref: Estimate made by American Iron & Steel Institute for Production, & Conserval Div. of Weass United
SIC 3312 Primary Metal Industries Stainless Steel Pickling Liquor	New England	.050		
	Mid Atlantic	.259		
	East North Central	.404		
	West North Central	.026		
	South Atlantic	.068		
	East South Central	.055		
	West South Central	.044		
	West	.067		
	Mountain	.028		
	Production Quantity 5X10^7			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hydrofluoric Acid	70,000	3	2	2	3	3	2	3	U	3	1.5		Drinking Water .8-1.7 mg/l max. <2.4 mg/l livestock. Burns skin, eyes, mucosa.	Lime and landfill CuF_2
Sulfuric Acid	100,000	3	2	2	3	3	2	3	U	2	1.5			Neutralize
Iron	40,000	1	2	1	1	3	1	1	U	1	1.5			
Chromium	4,500	3	2	2	3	3	1	3	U	2	1.25	113	TLV 0.1 mg/m^3; less than 0.05 ppm in drinking water	Ion exchange, activated carbon or chemical reduction and ppt
Nickel	4,100	2	2	1	2	2	1	1	2	1	1.25	289		Concentrate/precipitate
Cobalt														
Nitric Acid	300,000	3	3	1	3	3	2	3	2	1	1.5			Neutralize

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-3	
SIC 333 Nonferrous Brass Mill Brass Mill Wastes	New England	.04		Ref: Quanti:y taken from Booz-Allen Table III-6 quoted on dry weight basis
	Mid Atlantic	.29		
	East North Central	.01		
	West North Central	.25		
	South Atlantic	.01		
	East South Central	.04		
	West South Central	.04		
	West	.19		
	Mountain	.13	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 5X10^7	Specific Hazard Data (TRW, etc.)	Processes Which Adequately Treat a Constituent
Copper Sulfate	80,000	2	2	2	2	3	1	2	2	2	1.5	122			Concentrate and precipitate
Zinc	10,000	2	2	3	1	1	3	2	2	U	1.25				Concentrate and precipitate
Sodium Dichromate	10,000	3	1	U	3	1	3	3	1	U	1.5	379		TLV 0.1 mg/m^3	Reduction and precipitate
Sulfuric Acid	20,000	3	2	2	3	3	2	3	U	2	1.5				Neutralize
Bright Dip Liquor	NA														

WASTE STREAM

SIC 333 Smelting & Refining nonferrous Metals ESP.
SIC 3331 Copper
SIC 3332 Lead
SIC 3333 Zinc
TRW

Arsenic Trioxide from Smelting Ind. Wastes

C-4

Ref: TRW volume on waste forms assumes 95% recovery

GEOGRAPHIC DISTRIBUTION	
New England	--
Mid Atlantic	.03
East North Central	.015
West North Central	.07
South Atlantic	.005
East South Central	.01
West South Central	.10
West	.07
Mountain	.70

Production Quantity 2X10^7

Copper, lead, zinc refining

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Arsenic Trioxide	Solid	3	3	3	3	3	1	2	3	2	1.	50		1) Recycling and reprocessing 2) Burial
Selenium	3,000 -4,000	3	2	3	2	1	3	2	3	U	1.	367	TLV 0.1 mg/m^3 367 (powder)	Only recovery of lefumes from refinery covered by TRW other separate processes require R&D
Sulfuric Acid	70,000	3	2	2	3	3	2	3	U	2	1.			Neutralization
Hydrochloric Acid	40,000	3	1	2	3	3	1	3	U	2	1.			Neutralization
Copper	150	2	2	2	2	3	1	2	2	2	1.			Concentrate/precipitate
Lead	trace											233		Concentrate/precipitate
Mercury	trace											257		Recycle/storage
Antimony	trace											33		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-4	Ref: 277 lbs atmospheric emissions/ton prod. 86 tons prod. W.E. Davis & Assoc. "National Inventory of Sources and Emissions - Selenium" PB-210679, 5/72. Assumes 100% recovery
SIC 3339 Smelting and Refining, Non-ferrous Metals TRW #5 (V.2) P. 391 Selenium Prod. Wastes (Particulates)	New England			
	Mid Atlantic	.75		
	East North Central			
	West North Central			
	South Atlantic			
	East South Central			
	West South Central			
	West			
	Mountain	.25	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

		BOOZ-ALLEN RATINGS													
		AIR			WATER			LAND							
Constituents	Concentration of Constituent in Stream (ppm)	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	TRW Profile Number	Production Quantity 2X10⁴ (Particulates)	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Selenium		3	2	3	2	1	3	2	3	U	1.0	367		TLV, 0.2 mg/m³	Recycling and reprocessing

WASTE STREAM

SIC 3339
Smelting &
Refining
NonFerrous
Metals

Thallium
Production
Wastes

GEOGRAPHIC DISTRIBUTION

New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	.100
West	
Mountain	

A-5

SPECIFIC HAZARD DATA (TRW, etc.)

Ref: Estimate based on low production

PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
													Neg. (Small amt. prod. in Colorado)		
Thallium												430		TLV 0.1 mg/m^3	Sealed container to landfill

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-5	Ref: Estimate based on low production
SIC 3339 TRW #5 (V. 2) P. 230 Smelting and Refining Nonferrous Metals Beryllium Prod. Wastes	New England			
	Mid Atlantic	1.000		
	East North Central			
	West North Central			
	South Atlantic			
	East South Central			
	West South Central			
	West			
	Mountain		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Production Quantity Neg.			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Specific Hazard Data (TRW, etc.)	Processes Which Adequately Treat a Constituent
Beryllium Powder												59		Very little material to be disposed of as waste
Beryllium Carbonate		3	2	3	1	1	U	3	1	U	1.00	73	LD_{50}, 150 mg/kg	
Beryllium Chloride		3	2	3	2	1	U	3	2	U	1.00	74	LD_{50}, 86 mg/kg	
Beryllium Hydroxide		3	2	3	2	1	U	3	1	U	1.00	75	LD_{50}, 0.35-2.5 mg/kg	
Beryllium Oxide		3	2	3	1	1	U	3	1	U	1.00	76		
Beryllium Selenate		3	2	3	3	1	U	3	1	U	1.00	77		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOS-ALLEN RATINGS										TBW Profile Number	GEOGRAPHIC DISTRIBUTION	B-1 and C-4 SPECIFIC HAZARD DATA (TBW, etc.)	Ref : Estimate by Hydronics Corp. letter to Elton Hall, Battelle-Columbus 10-18-72 for Chicago area. Assume Chicago is 10% of national total PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 33 &34 Metal Finishing Wastes		AIR			WATER			LAND					New England .115 Mid Atlantic .179 East North Central .379 West North Central .046 South Atlantic .050 East South Central .015 West South Central .036 West .169 Mountain .011		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
													Production Quantity 8X10^6 metal sludges	& 4X10^7 cyanide solutions	
Constituents															
Summary Sheet for Next 11 Streams															

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-3	Ref: 11.7 gal/lb anodized - single company estimate
SIC 3471, 3479 Aluminum Anodizing Bath with Drag Out	New England	0.115		
	Mid Atlantic	0.179		
	East North Central	0.379		
	West North Central	0.046		
	South Atlantic	0.050		
	East South Central	0.015		
	West South Central	0.036		
	West	0.169		
	Mountain	0.011	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	Specific Hazard Data	Processes Which Adequately Treat a Constituent
Chromium	3,000	3	2	2	3	3	1	3	U	2	1.25	113		TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water.	Ion exchange, activated carbon, or chemical reduction and ppt.
Aluminum Sulfate	200,000	3	3	2	3	2	2	3	U	2	1.5				
Sulfuric Acid	300,000	3	2	2	3	3	2	3	U	2	1.5				Neutralization

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 3471	New England	0.115
	Mid Atlantic	0.179
	East North Central	0.379
	West North Central	0.046
	South Atlantic	0.050
	East South Central	0.015
	West South Central	0.036
	West	0.169
Brass Plating Wastes	Mountain	0.011

B-1

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Copper Cyanide	68,500	2	U	2	2	U	2	1	U	2	1.0	120		TLV 5 mg/m^3	Alkaline Oxidation
Zinc Cyanide	52,000	3	U	2	3	U	2	2	U	2	1.0	457		TLV 5 mg/m^3	Alkaline Oxidation
Zinc Phosphate	50,000 100,000													----	-----
Zinc Chromate	50,000 100,000													----	-----
Hydrogen Cyanide		3	3	3	3	3	2	3	U	3	1.5	218		TLV 11 mg/m^3. Protoplasmic poison. Can be explosive. Hydrocyanic acid is esp. toxic	1) Incineration with NO_x scrubbing. 2) Scrub with potassium or sodium hydroxide to form cyanide salts.

BINDING EDGE

WASTE STREAM

Cadmium Platin
Wastes

B-1

Ref: TRW volume on waste forms

GEOGRAPHIC DISTRIBUTION	
New England	.131
Mid Atlantic	.285
East North Central	.321
West North Central	.045
South Atlantic	.049
East South Central	.023
West South Central	.036
West	.103
Mountain	.007

Production Quantity
$1X10^6$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Cadmium	23,000	3	3	2	3	U	1	1	U	2	1.25	81	----	Controlled Storage
Cadmium Cyanide	57,700	3	2	2	3	2	2	1	2	2	1.0	84	TLV 5 mg/m^3	Alkaline Oxidation
Hydrogen Cyanide		3	3	3	3	3	2	3	U	3	1.5	218	TLV 11 mg/m^3. Protoplasmic poison. Can be explosive. Hydrocyanic acid is esp. toxic.	1) Incineration with NO_x scrubbing. 2) Scrub with potassium and sodium hydroxide to form salts.

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-3	
SIC 3471 TRW #4 P. 18 Chrome Plating Wastes	New England	0.115		Ref: TRW volume on waste forms
	Mid Atlantic	0.179		
	East North Central	0.379		
	West North Central	0.046		
	South Atlantic	0.050		
	East South Central	0.015		
	West South Central	0.036		
	West	0.169		
	Mountain	0.011		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chromates (Cr^{+6}) Sod.	400											386		TLV, 0.1 mg/m^3	1) Reduction-precipitation for concentrated chromate wastes (for NDS)
Fe_2O_2	29													----	2) Electroreduction (efficient for large scale removal)
CuO	25													----	3) Direct precipitation 4) Ion exchange 5) Ion flotation
															6) Dialysis 7) Reverse osmosis 8) Liquid-liquid extraction
															NOTE: 3) through 8) not recommended for NDS
Chromic (Cr^{+3}) Sulfate												486		TLV, 0.5	1) Ion exchange 2) Discharge to municipal sewers 3) Direct precipitation
Chromic Hydroxide Sludge														----	1) Landfill 2) Ocean disposal 3) Incineration and landfill

14-3000-459 (3-65)
AEC-RL RICHLAND WASH

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		B-1	Ref: TRW volume on waste forms
SIC 3471 Cyanide Copper Plating Wastes	New England	.115		
	Mid Atlantic	.179		
	East North Central	.379		
	West North Central	.046		
	South Atlantic	.050		
	East South Central	.015		
	West South Central	.036		
	West	.169		
	Mountain	.011		
	Production Quantity $2x10^6$			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Copper Cyanide	40,000	2	U	2	2	U	2	1	U	2	1.0	120	TLV 5 mg/m^3	Alkaline Oxidation
Hydrogen Cyanide		3	3	3	3	3	2	3	U	3	1.5	218	TLV 11 mg/m^3. Protoplasmic poison. Can be explosive. Hydrocyanic acid is especially toxic.	1) Incineration with NO_x scrubbing. 2) Scrub with potassium or sodium hydroxide to form cyanide salts.

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		B-1
SIC-34 Fabricated Metal Products Finishing Effluents	New England	.115	
	Mid Atlantic	.179	
	East North Central	.379	
	West North Central	.046	
	South Atlantic	.050	
	East South Central	.015	
	West South Central	.036	
	West	.169	
	Mountain	.011	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Copper Cyanide	6-300 ppm	2	U	2	2	U	2	1	U	2	1.0	120		TLV 5 mg/m^3	Alkaline Oxidation
Copper Sulfate	NA	2	2	2	2	3	1	2	2	2	1.5	122		----	Concentrate/precipitate
Ferrous Sulfate	2-21 ppm	1	2	1	1	3	1	1	U	1	1.5			----	----
Nickel Cyanide	0-300 ppm	3	U	2	3	U	2	2	3	2	1.0	295		TLV 5 mg/m^3	Alkaline Oxidation
Nickel Sulfate	NO	2	3	2	1	3	1	2	U	1	1.25	298		----	Concentrate/precipitate
Zinc Cyanide	0-300 ppm	3	U	2	3	U	2	2	U	2	1.0	457		TLV 5 mg/m^3	Alkaline Oxidation
Sodium Dichromate	.5 to 700 ppm	3	1	U	3	1	3	3	1	U	1.5	379		TLV 0.1 mg/m^3	Reduction Precipitation
Chromic Hydroxide	30,000													----	Acid Reduction
Zinc Ferrocyanide	25,000													----	Alkaline Oxidation
Calcium Fluoride	20,000	3	1	2	3	U	1	2	U	2	1.5			----	Landfill

54-3000-469 (6-65)
AEC-RL RICHLAND WASH

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-6
SIC 347 Metal Cleaning Wastes	New England	.115	
	Mid Atlantic	.179	
	East North Central	.379	
	West North Central	.046	
	South Atlantic	.050	
	East South Central	.015	
	West South Central	.036	
	West	.169	
	Mountain	.011	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TBW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Copper Salts	2,000	2	2	2	2	3	1	2	2	2	1.0				Concentrate/precipitate
Nitric Sulfuric*,Hydrochloric Acids	500 000	3	1	2	3	3	1	3	U	2	1.5				Neutralize
Cyanide	trace	2	U	2	3	U	2	2	U	2	1.0	129		TLV 5 mg/m^3	Alkaline Oxidation
Chromium	trace	3	2	2	3	3	1	3	U	2	1.0	113		TLV 0.1 mg/m^3. Less than 0.0 ppm in drinking water	Ion exchange, activated carbon, or chemical reduction and ppt
Lead	trace	3	2	2	3	U	1	1	U	2	1.5	233			Concentrate/precipitate
Nickel	trace	2	2	1	2	2	1	1	2	1	1.2	289			Concentrate/precipitate
Zinc	trace	2	3	2	1	3	1	2	U	2	1.2				Concentrate/precipitate
Cadmium	trace	3	3	2	3	U	1	1	U	2	1.2	81			Controlled Storage
Iron	trace	1	2	1	1	3	1	1	U	1	1.5				
Oxalic Acid												317		TLV 1 mg/m^3 Oral LD, 1g/Kg	1) Neutralization and incineration 2) Activated Sludge

WASTE STREAM

SIC 347

Metal Cleaning Wastes

A-6

GEOGRAPHIC DISTRIBUTION	
New England	.115
Mid Atlantic	.179
East North Central	.379
West North Central	.046
South Atlantic	.050
East South Central	.015
West South Central	.036
West	.169
Mountain	.011

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TBM Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TBM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Copper Salts	2,000	2	2	2	2	3	1	2	2	2	1.0			----	

54-3000-469 (8-65)
AEC-RL RICHLAND, WASH

BINDING EDGE

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 347 Plating Preparation	New England	.115
	Mid Atlantic	.179
	East North Central	.379
	West North Central	.046
	South Atlantic	.050
	East South Central	.015
	West South Central	.036
	West	.169
	Mountain	.011

A-3

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chromium	5,000	3	2	2	2	3	2	1	U	2	1.25	113		TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water	Ion exchange, activated carbon, or chemical reduction and ppt
Copper	400	2	2	2	2	3	1	2	2	2	1.0				Concentrate and precipitate
Nickel	600	2	2	1	2	2	1	1	2	1	1.25	289			Concentrate and precipitate
Hydrofluoric Acid	50,000													Max. drinking water levels 0.8-1.7 mg/l for people, <2.4 mg/l for livestock. Burns skin, eyes, mucosa	Lime to CaF$_2$ and landfill

TOP

WASTE STREAM

SIC 3471

Silver Plating Wastes

GEOGRAPHIC DISTRIBUTION	
New England	.115
Mid Atlantic	.179
East North Central	.379
West North Central	.046
South Atlantic	.050
East South Central	.015
West South Central	.036
West	.169
Mountain	.011

B-1

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
Silver Cyanide	45,000	3	U	2	3	U	2	2	U	2	1.	370	▨		Alkaline oxidation
Hydrogen Cyanide		3	3	3	3	3	2	3	U	3	1.5	218	▨	TLV 11 mg/m^3. Protoplasmic poison can be explosive. Hydrocyanic acid is especially toxic	1) Incineration with NO_x scrubbing 2) Scrub with potassium and sodium hydroxide to form cyanic salts
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

54-3000-469 (8-68)
AEC-RL RICHLAND WASH

BINDING EDGE

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		WASTE STREAM Continued
SIC 3411 Metal Cans; 3312 Steel Works & Rolling Mills; 3479 Coating, Engraving and Allied Services And other categories in group 33 & 34	New England	0.115	3451 and 3452 Bolts, Nuts, Screw, etc. Zinc Plating Wastes
	Mid Atlantic	.179	B-1
	East North Central	.379	
	West North Central	.046	
	South Atlantic	.050	
	East South Central	.015	
	West South Central	.036	
	West	.169	
	Mountain	.011	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Zinc Plating	33,800	2	2	3	1	1	3	2	2	U	1.25		▨		Concentrate/precipitate
Zinc Cyanide	48,900	3	2	U	3	2	U	2	2	U	1.0	457	▨	TLV 5 mg/m^3	Alkaline oxidation
Sodium Hydroxide	38,000 - 100,000	2	2	1	2	2	3	3	2	U	1.5		▨		Neutralize
Hydrogen Cyanide		3	3	3	3	3	2	3	U	3	1.5	218	▨	TLV 11 mg/m^3. Protoplasmic poison. Can be explosive. ~~Hydrocyanic acid is especial~~ly toxic	1) Incineration with NO_x scrubbing 2) Scrub with po~~tassium and sodium hydroxide~~ to form cyanide salts
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND								
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating					
SIC 34 Metal Finishing Chromic Acid		3	2	2	2	3	2	1	U	2	1.2		New England	0.244	A-5	Ref: TRW volume on waste forms
													Mid Atlantic	0.198		
													East North Central	0.149		
													West North Central	0.095		
													South Atlantic	0.081		
													East South Central	0.032		
													West South Central	0.031		
													West	0.031		
													Mountain	0.041		
													Production Quantity 4.4 x 10^7		TLV 0.1 mg/m^3 less than 0.0 ppm in drinking water	1) Ion exchange 2) Activated carbon adsorption 3) reduction followed by precipitation by PH adjustment NDS
Constituents												114				

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS: AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION		B-4 SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 3555 Printing Mach. Rotogravure Printing Plate Wastes	▨											▨	New England	.105		
													Mid Atlantic	.446		
													East North Central	.320		
													West North Central	.051		
													South Atlantic	.019		
													East South Central	.000		
													West South Central	.028		
													West	.031		
													Mountain	.000		
													Production Quantity 9,9x10^{11} (all SIC 35			
Constituents																
Copper	80,000	2	2	2	2	3	1	2	2	2	1.0		▨			Concentrate/precipitate
Nickel	1,000	2	2	1	2	2	1	1	2	1	1.25	289	▨			Concentrate/precipitate
Lead	1,000	3	2	2	3	U	1	1	U	2	1.5	233	▨			Concentrate/precipitate
Sodium Hydroxide	300,000	2	2	1	2	2	3	3	2	U	1.5		▨			Neutralize
Complex Organic Acids													▨			
Zinc													▨			Concentrate/precipitate
Chromium		3	2	2	3	3	1	3	U	2	1.25	113	▨		TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking H_2O	Ion exchange, activated carbon or chemical reduction and percipitate
													▨			
													▨			
													▨			

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-4	Ref: Direct plant contact and TRW volume on waste forms
SIC 3555 Printing Trades Mach. SIC 3579 Office Machines Duplicating and Photo Equipment Manufacturing Wastes	New England			
	Mid Atlantic			
	East North Central			
	West North Central			
	South Atlantic			
	East South Central			
	West South Central			
	West			
	Mountain		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 7X10^5	Specific Hazard Data	Processes Which Adequately Treat a Constituent
Selenium	3,000-50,000	3	3	2	2	3	1	2	U	3	1.0	367		367 (Powder)	Only recovery of lefumes from refinery covered by TRW. Other sep. processes require R&D
Sodium Hydroxide	100,000	2	2	1	2	2	3	3	2	U	1.5				Neutralize
Arsenic	1,000-30,000	3	3	2	3	3	1	2	3	2	1.25	46		Toxic in all forms	Concentrate and store (poss. shipment to reprocessing site)
Arsenic Triselenide	10,000-100,000														Reprocess or bury

WASTE STREAM	
SIC 3573 Electronic Computing Equipment Computer Manufacturing Wastes	B-1

GEOGRAPHIC DISTRIBUTION	
New England	.143
Mid Atlantic	.342
East North Central	.170
West North Central	.037
South Atlantic	.053
East South Central	.019
West South Central	.032
West	.165
Mountain	.039
Production Quantity 9.9×10^{11} (all SIC 35	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
														NDS
Sodium Cyanide	150,000	3	2	3	3	2	3	2	2	U	1.5	387	TLV 5 mg/m^3	Alkaline oxidation by chlorination
Sodium Ferricyanide	50,000												TLV 5 mg/m^3	Alkaline oxidation
Sodium Ferrocyanide	50,000												TLV 5 mg/m^3	Alkaline oxidation
Nickel	trace	2	2	1	2	2	1	1	2	1	1.25	28		Concentrate & precipitate
Zinc	trace	2	3	2	1	3	1	2	U	2	1.25			Concentrate & precipitate
Freon	10,000													
Ammonium Fluoride	20,000	3	2	2	3	1	2	3	2	U	1.25	25		
Hydrofluoric Acid	20,000	3	2	3	3	1	3	3	2	U	1.5		Max. drinking H_2O level 0.8-1.7 mg/l for humans, <2.4 mg/l for livestock. Burns ski eyes, mucosa	Lime and landfill CaF2
Cadmium Chromate	300-500													
Thallium										1,000		43	TLV 0.1 mg/m^3	Sealed containers to landfill

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-4	Ref: 200 gal waste/unit estimated from Ohio Dept. of Health-Corps. of Eng. discharge permits. 10^7 units annual prod. from "Stat. Abs. of U.S., 1970"-Assume 1% as active sludge and contaminated wastes-rest is cooling water, etc.
SIC 3585 Refrigeration Machinery SIC 3632 Refrigerators and Freezers Refrigeration Equipment Manufacturing Wastes	New England	.011	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mid Atlantic	.232		
	East North Central	.408		
	West North Central	.096		
	South Atlantic	.040		
	East South Central	.069		
	West South Central	.086		
	West	.045		
	Mountain	.011		
	Production Quantity 2X10^8			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number		Specific Hazard Data	Processes Which Adequately Treat a Constituent
Fluoride												389	▨		Precipitate with lime
Chromates												386	▨	Hexavalent chrome is carcinogenic	
Aluminum													▨		
Heavy Metals													▨		
Acid													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-3	Ref: TRW volume on waste forms
SIC 36 Electrical and Electronic Electronic Circuitry Manufacturing Wastes	New England	.143		
	Mid Atlantic	.342		
	East North Central	.170		
	West North Central	.037		
	South Atlantic	.053		
	East South Central	.019		
	West South Central	.032		
	West	.165		
	Mountain	.039		
	Production Quantity 5X10^{5}			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Potassium Ferrocyanide	10,000													Alkaline oxidation
Sodium Hydroxide	100,000	2	2	1	2	3	2	3	U	2	1.5			Neutralize
Lead	10-1,500	3	2	2	3	U	1	1	U	2	1.5	233		Concentrate/precipitate
Nickel	10-1,500	2	2	1	2	2	1	1	2	1	1.25	289		Concentrate/precipitate
Chromium	10-50	3	2	2	2	2	3	1	2	U	1.25	113	TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water	Ion exchange, activated carbon or chemical reduction and precipitate
Copper	3,000-50,000	2	2	2	2	3	1	2	2	2	1.			Concentrate/precipitate
Hydrochloric Acid	150,000 350,000	3	2	1	3	1	3	3	2	U	1.5			Neutralize
Sulfuric Acid	10,000 250,000	3	2	2	3	2	3	3	2	U	1.5			Neutralize
Hydrocyanic Acid		3	3	3	3	3	2	3	U	3	1.5	215	TLV 0.5 mg/m^3. Protoplasmic poison. Can be explosive. Hydrocyanic acis is especially toxic.	1) Incinerate with NO$_x$ scrubber. 2) Scrub with potassium or sodium hydroxide to form cyanide salts
Carbon Tetrachloride		3	1	2	3	2	1	2	U	2	1.5			
Chloroform		3	2	2	1	3	2	1	U	2	1.5			

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 3662,3671 3672,3673 Electronic Tube Production Wastes	New England	.143
	Mid Atlantic	.342
	East North Central	.170
	West North Central	.037
	South Atlantic	.053
	East South Central	.019
	West South Central	.032
	West	.165
	Mountain	.039

C-4

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TSW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TSW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Cupric Hydroxide	4.5% Solid														
Nicklic Hydroxide	.3% Solid														
Calcium Phosphate	70% Solid														
Mercury	trace	3	U	2	3	3	1	3	U	1	1.0	257			Recycle, storage
Barium Compounds		2	2	1	3	3	2	1	U	1	1.0	53		Highly toxic when ingested. TLV 0.5 mg/m^3. MPC in drink water 1 ppm	1) Precipitate as sulfate with sulfuric acid 2) ion exchange 3) Reverse osmosis 4) adsorption on actived carbon
Hydrogen Fluoride		3	3	2	3	3	1	3	U	2	1.5			Burns. TLV 3 ppm. Max. drinking levels 0.8-1.7 mg/l for people, <2.4 mg/l for livestock	Lime and landfill resulting CaF2.

BINDING EDGE

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 3679 Magnetic Tape Productions	New England	.171
	Mid Atlantic	.336
	East North Central	.165
	West North Central	.120
	South Atlantic	.077
	East South Central	.016
	West South Central	.060
	West	.060
	Mountain	-

C-3

Production Quantity $1.4x10^{12}$ (all SIC 36)

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Ammonium Dichromate	10-50% dichromate solid	3	2	2	2	2	1	3	U	2	1.25	22		Chemical reduction/precipitate
Dirt and Organics	trace													Chemical reduction/precipitate
Chromic Oxide	5-50% sludge											114		
Chromic Oxide	5-10% in waste filters											114		
Ethylene Dichloride	100,000	3	2	1	3	1	2	2	2	U	1.5			

TOP

WASTE STREAM

SIC 3691 Storage Batteries
SIC 3692 Primary Batteries

Battery Manufacture Sludges (40% Solids)

GEOGRAPHIC DISTRIBUTION	
New England	.030
Mid Atlantic	.236
East North Central	.289
West North Central	.111
South Atlantic	.103
East South Central	.029
West South Central	.056
West	.134
Mountain	.012

C-4

Ref: TRW volume on waste forms

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 5X10^7	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Cadmium Carbonate Hydroxide	4% Sludge	3	2	2	3	U	1	1	U	2	1.0			Cadmium is bioaccumulative and toxic	1) Recovery of cadmium 2) Secured burial of sludge
Nickel Carbonate	3% Sludge														
Copper Hydroxide	trace														
Lead Sulfate	2,500														
Arsenic												46		Toxic in all forms	Conc. and store (poss. shipment to reprocessing site)
Antimony												33			

WASTE STREAM

SIC 3691 Storage Batteries
SIC 3692 Primary Batteries

Battery Manufacture Wastes

B-4

GEOGRAPHIC DISTRIBUTION	
New England	.030
Mid Atlantic	.236
East North Central	.289
West North Central	.111
South Atlantic	.103
East South Central	.029
West South Central	.056
West	.134
Mountain	.012

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Cadmium Oxide	80,000	3	2	2	3	U	1	1	U	2	1.0	85		Bioaccumulative and toxic	1) Carbon absorption 2) Lime coagulation, sedimentation, sand bed filtration
Nickelic Oxide	6,000														
Potassium Hydroxide	140,000	3	2	2	3	3	2	3	U	2	1.5				Neutralize
Arsenic												46		Toxic in all forms	Conc and store (poss. shipment to reprocessing site)
Antimony												33			

54-3000-459 (8-55)
AEC-RL RICHLAND, WASH

WASTE STREAM

SIC 3692 Primary Batteries

Mercury Cell Battery Wastes

GEOGRAPHIC DISTRIBUTION	
New England	.060
Mid Atlantic	.138
East North Central	.556
West North Central	.049
South Atlantic	.074
East South Central	.019
West South Central	.017
West	.087*
Mountain	*Mtn & W combined

C-4

Production Quantity 1.4x10^{12} (all SIC 36)

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Mercury												257	Bioaccumulative and toxic when methylated	Recycle, storage

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		B-1	Ref: Stream is 15,000 ppm $Cd(CN)_2$ Aircraft & Ship bldg. require 800,000#/yr Cd according to Booz-Allen. Assume typical plating losses of 50%
SIC 3721, 3724, 3728 Aircraft and Parts Aircraft Plating Wastes	New England	.123		
	Mid Atlantic	.158		
	East North Central	.117		
	West North Central	.093		
	South Atlantic	.057		
	East South Central	.013		
	West South Central	.095		
	West	.325	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mountain	.019		
	Production Quantity 4X10^7			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	Ecological	Explosion	WATER Human	Ecological	Explosion	LAND Human	Ecological	Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Cadmium Cyanide	15,000	3	2	2	3	2	2	1	2	2	1.0	129		TLV 5 mg/m^3	Oxidation at high pH to destroy cyanide, followed by carbon absorption or lime coagulation
Sodium Cyanide	85,000	3	2	3	3	2	3	2	2	U	1.5	387		TLV 5 mg/m^3	Alkaline oxidation with chlorination
Sodium Hydroxide	30,000	2	2	1	2	2	3	3	2	U	1.5				Neutralization

WASTE STREAM

SIC 40,41,47
Transportation

Railroad Engine
Cleaning

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

B-4

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TBW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Chromate	2,000	3	1	3	3	1	2	3	1U	1.5	386			TLV 0.1 mg/m^3	Chemical reduction/precipitate
Diesel Fuel															
Alkaline Cleaner															

WASTE STREAM

SIC 40,41,42,
43,44,45,47
Transportation

Rollins

Arsenic Wastes from Transportation Company

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

C-4

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
													▨		
Arsenic Oxide Powder												51	▨	Arsenic is toxic in all forms	Long-term storage
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TSW Profile Number	GEOGRAPHIC DISTRIBUTION	C-1	Ref: PCB production for transformers and capacitors 1972 projection - COM-72-10419 Interdepartmental Task Force on PCB's, May 1972
SIC 491,493, 496 Utilities Utilities and Elec. Station Wastes		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TSW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Constituents													Production Quantity 3×10^7		
Polychlorinated biphenyls		3	U	2	2	U	1	2	U	1	1.0	507		TLV 0.5-1.0 mg/m^3	High temp. incineration with alkaline scrubbing

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	C-4	Ref: TRW volume on waste forms - assumes 100% recovery
IC 491,493,496 lectronic Serv- ces and Com- ined Utilities team Supplies TRW #5(V.2) P. 188 Arsenic Tri- chloride Scav- enged from Coal Power Plants		AIR			WATER			LAND					New England .05 Mid Atlantic .23 East North Central .07 West North Central .05 South Atlantic .33 East South Central .25 West South Central -- West -- Mountain .07	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity 6X10^6 Sludge		
Constituents															
Arsenic Trichloride		3	3	3	3	3	1	2	3	2	1.0	50		TLV, 0.5 mg/m^3	1) Recycling and reprocessing

Rollins

WASTE STREAM

SIC 9711
National
Security

Arsenic Wastes
from Military
(Solid) and
Riot Control
Agents

GEOGRAPHIC DISTRIBUTION	
New England	-
Mid Atlantic	.002
East North Central	.001
West North Central	-
South Atlantic	.015
East South Central	.031
West South Central	.001
West	.926
Mountain	.024

Production Quantity
$3X10^6$

C-4

Ref: TRW final report take
from Department of
Defense statistics

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Arsenate Crystal	45%											376	▨		Long-term storage

WASTE STREAM

SIC 2859 Ind. Org. Chem. SIC 9711 Nat. Sec. SIC 9221 Police Protection
TRW #8 P. 119

Contaminated or Outdated Tear Gas and Other Conventional Munitions Scheduled for Disposal

C-1

Ref: TRW final report taken from Department of Defense statistics

GEOGRAPHIC DISTRIBUTION	
New England	-
Mid Atlantic	.138
East North Central	.189
West North Central	-
South Atlantic	.022
East South Central	.044
West South Central	.252
West	.209
Mountain	.144

Production Quantity 3X10

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	Ecological	Explosion	WATER Human	Ecological	Explosion	LAND Human	Ecological	Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
2-Chloro-benzylidene Malononitrile (CS)												423	TLV 0.4. Class C poison	Hydrolyze in 95% ethanol. Incinerate products with caustic scrubbing

WASTE STREAM

SIC 9711
Drugs and Contraband Seized by Customs

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
	▨											▨			
													▨		
Chloroamphenical													▨	Narcotic	
Dextroamphetamine													▨	"	
Barbituates													▨	"	
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 9711 Nat. Security

Explosives from Military Ordinance

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

C-6

SPECIFIC HAZARD DATA (TRW, etc.)

Ref: TRW from Department of Defense

PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	4×10^8		
													▨		
Bombs-shells etc.													▨		Detonate
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 9711 National Security Highly Contaminated Soil (Stored)	New England		C-4	Ref: TRW volume on waste forms
	Mid Atlantic			
	East North Central			
	West North Central			
	South Atlantic			
	East South Central			
	West South Central			
	West			
	Mountain	1.00		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS: AIR: Human	AIR: Ecological	AIR: Explosion	WATER: Human	WATER: Ecological	WATER: Explosion	LAND: Human	LAND: Ecological	LAND: Explosion	Production Rating	TRW Profile Number	Production Quantity 3X10^9		Rocky Mountain Arsenal
AS_2O_3 etc.		3	3	3	3	3	1	2	3	2	1.0	51			

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	A-3	Ref: TRW volume on waste forms
		AIR			WATER			LAND							
SIC 9711 Military Sodium Chromate		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity 2765		Stored in Okinawa
Constituents													▨		
Sodium Chromate		3	1	3	3	1	2	3	1	U	1.5	386	▨	TLV 0.1 mg/m^3	Chemical reduction/ precipitate
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	A-5	Ref: Summary USAF report by W. B. Mabson, 1970
SIC 9711 National Security Military Cadmium Wastes from Plating	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 2×10^6	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Cadmium Oxide	3% Solid											85		Toxic and bioaccumulative	Lime coagulation, sedimentation, filtration. Possible reclamation from sludges
Cadmium Metals	16%											81		" "	" " "

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 9711 Military Pari Green-Stored	New England	
	Mid Atlantic	
	East North Central	1.0
	West North Central	
	South Atlantic	
	East South Central	
	West South Central	
	West	
	Mountain	
	Production Quantity 3X10^4	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TSW Profile Number	SPECIFIC HAZARD DATA (TSW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND						
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating			
Copper Aceto-Arsenite		3	3	2	3	U	1	2	U	2	2.0	490	TLV 0.5 mg/m^3 Toxic poison	Safe Storage

Rolling III GC

C-6

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 9711 Military Product Nat. Security Solid Powder Military Waste Spent Filter Media		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
DDT	10%	3	2	1	2	3	1	3	3	1	1.2	137		Oral LD_{50}, 113-118 mg/Kg; Dermal LD_{50}, 2500 mg/Kg; TLV 0.1 mg/m^3	1) Activated carbon 2) High temp. incineration with alkaline scrubbing
Pratomaceous earth	90%														

Rollins III GC

C-1

WASTE STREAM

SIC 9711
Military
Nat. Security

Off-Spec "Agent Orange" Defoliant

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
2,4-D	50%	2	2	2	2	3	1	2	2	2	1.25	135		Attacks broadleafs. Moderately toxic to mammals. TLV 10 mg/m3	1) Adsorb on activated carbon 2) Biological treatment 3) Ion exchange 4) Incinerate concentrated wastes
2,4,5-T as butyl and/or Iso Octyl Esters	50%														

WASTE STREAM

SIC 9711
National
Security

Paint Stripping
Wastes Vance
Air Force Base,
OK

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	1,000
West	
Mountain	

C-6

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phenols	5	3	2	2	3	1	3	3	2	U	1.5				
Cadmium	.4	3	2	3	3	1	U	1	2	U	1.25	81			Controlled storage
Chromium	47	3	2	2	3	1	3	3	2	U	1.25	113		TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water	Ion exchange, activated carbon, or chemical reduction and precipitate
Copper	1.6	2	2	2	2	1	3	2	2	2	1.5				Concentrate/precipitate
Lead	.6	3	2	2	3	1	U	1	2	U	1.5	233			Concentrate/precipitate
Manganese	.02	3	2	U	1	1	U	1	1	U	1.0				
Zinc	4	2	2	3	1	1	3	2	2	U	1.25				Concentrate/precipitate
Methylene Chloride	500														
Acetone	5,000	2	2	2	2	1	1	1	2	U	1.5				

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-4	Ref: TRW from Department of Defense
SIC 9711 National Security Stored Military Mercuric Compounds	New England	.47		
	Mid Atlantic			
	East North Central			
	West North Central	.51		
	South Atlantic			
	East South Central			
	West South Central			
	West	.02	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mountain			
	Production Quantity 215			

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Specific Hazard Data	Processes Which Adequately Treat a Constituent
Mercuric Nitrate		3	U	3	3	3	1	3	U	3	1.0	255	Bioaccumulative and toxic	Add HCL and zinc to recover mercury. Neutralize with lime
Mercury Chlorides		3	3	2	3	3	1	3	U	2	1.0	253	" "	

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TSM Profile Number	GEOGRAPHIC DISTRIBUTION	C-4	Ref: Memo from Defense General Supply Center
SIC 9711 Defense Waste Chemicals from Military		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating			SPECIFIC HAZARD DATA (TSM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity 3X10^5		
Constituents													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	C-1	Ref: Discussion with Mrs. Brandon of American Type Culture Association
		AIR			WATER			LAND							
Etiological Materials from Commercial Operations		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity 3X10		
Constituents													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

Cooling Tower Blowdown

A-3

Ref: TRW volume on waste forms

GEOGRAPHIC DISTRIBUTION	
New England	.005
Mid Atlantic	.15
East North Central	.17
West North Central	.06
South Atlantic	--
East South Central	.58
West South Central	--
West	--
Mountain	.035

Production Quantity $2X10^7$ as chromate

		BOOZ-ALLEN RATINGS													
		AIR			WATER			LAND							
Constituents	Concentration of Constituent in Stream (ppm)	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Chromate		3	1	3	3	1	2	3	1	U	1.5	386		TLV 0.1 mg/m^3	Reduction/precipitate Electro reduction

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
Radioactive Waste from Miscellaneous Private Source 1980 Liquid and Solid	▨											▨	Production Quantity 1970 (tons/yr) 0.1-2x10^5		
Constituents															
Co-60	<80,000												▨		Liquids - Scavenging precipitation, evaporation, dilution.
Cs-137	<1,200												▨		
P-33	<2,900												▨		Solids - Compaction and incineration followed by encapsulation and burial
Pm-147	<295,000												▨		
Sr-90	<33,000												▨		
H-3	<27,000												▨		
Others	<300												▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 5c/Fuel Fabrication Solid$^{A-9,A-10}$	New England	.10
	Mid Atlantic	.20
	East North Central	--
	West North Central	--
	South Atlantic	.30
	East South Central	.10
	West South Central	.10
	West	.20
	Mountain	--

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 1.8 E6 (Ft^3/yr) 1980	SPECIFIC HAZARD DATA (TRW, etc.) 780 tons - 1970	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
U-234	1.1 E2														Existing: Compaction, Packaging for burial
U-235	9.0 E-3														
U-238	2.0 E-3														
Pu-238	1.9 E4														
Pu-239	3.9 E3														
Pu-240	4.8 E3														
Pu-241	1.3 E6														
Total	1.3 E6														

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND								
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating					
Fuel Irradiation 6c - Solid*													New England	.10		
													Mid Atlantic	.20		
													East North Central	.20		
													West North Central	<.05		
													South Atlantic	.30		
													East South Central	.10		
													West South Central	<.05		
													West	<.05		
													Mountain	.10		
													Production Quantity 1.0 E6 (Ft^3/yr) 1980		1970 - 1305 tons	
Constituents																
2/2 Cd-109,115	6.2 E4															
In-114	8.0 E2															
Cs-134,137	5.2 E4															
Ce-141,144	4.0 E2															
Others-Cr-51;Zn-65; I-129	--															
Total	2.2 E7															

(a) Production quantity includes 7×10^5 ft^3/yr of trash, (papers, rags, plastic, used clothing), 1.4×10^4 ft^3/yr of activated equipment (primarily control rods), and 3.3×10^5 ft^3/yr of treated (solidified) liquids and resins.

(b) For additional bases and assumptions see pages 1.5, 1.6, and 6.3 of Reference ($A-^9$).

*Continued on next page.

WASTE STREAM

Radioactive Wastes

Commercial Nuclear Fuel Cycle - 1980

6c/Fuel Irradiation Solid^{A-9}

GEOGRAPHIC DISTRIBUTION	
New England	.10
Mid Atlantic	.20
East North Central	.20
West North Central	<.05
South Atlantic	.30
East South Central	.10
West South Central	<.05
West	<.05
Mountain	.10

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TMW Profile Number	Production Quantity 1980	SPECIFIC HAZARD DATA (TMW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	1.0 E6 (a) (Ft^3/yr)	1970 - 1305 tons	
H-3	3.5 E5												▨		Existing: Compaction (as appropriate), packaging for burial
Mn-54	2.5 E5												▨		
Fe-55,59	8.1 E6												▨		
Co-58,60	5.0 E4												▨		
Ni-59,63 .	1.3 E5												▨		
Sr-89,90	4.3 E2												▨		
Zr-95	8.1 E1												▨		
Nb-95	1.7 E2												▨		
Ru-103,106	8.3 E4												▨		
Ag-108,110	1.3 E7												▨		

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 7d/Reprocessing Solid except Hi-Level		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England -- Mid Atlantic .30 East North Central .10 West North Central -- South Atlantic .60 East South Central -- West South Central -- West -- Mountain --		
	▨											▨	Production Quantity 1980 2.5 E5 (a) (Ft^3/yr)	1970 - 141 tons	
Constituents															
Sr-89	2.2 E4												▨		Existing: Compaction (as appropriate), packaging for burial, storage, geologic containment
Sr-90	1.8 E4												▨		
Y-91	3.7 E4												▨		
Zr-95	6.3 E4												▨		
Nb-95	1.2 E5												▨		
Ru-103	2.0 E4												▨		
Ru-106	9.3 E4												▨		
Cs-134	4.8 E4												▨		
Cs-137	2.4 E4												▨		
Pm-147	2.3 E4												▨		

WASTE STREAM 7d, page 2	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England -- Mid Atlantic .30 East North Central .10 West North Central -- South Atlantic .60 East South Central -- West South Central -- West -- Mountain --	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
													Production Quantity 1980 2.5 E5 (a) (Ft^3/yr)	1970 - 141 tons	
Constituents															
Ce-141	1.3 E4														
Ce-144	1.8 E5														
Pu-238	1.8 E4														
Pu-239	2.7 E3														
Pu-240	4.2 E3														
Pu-241	1.1 E6														
I-129	9.3 E1														
Mn-54	1.5 E4														
Fe-55	6.4 E5														

WASTE STREAM

Radioactive Wastes

Commercial Nuclear Fuel Cycle - 1980

7d, page 3

GEOGRAPHIC DISTRIBUTION	
New England	--
Mid Atlantic	.30
East North Central	.10
West North Central	--
South Atlantic	.60
East South Central	--
West South Central	--
West	--
Mountain	--

Production Quantity 1980 2.5 E5 (a) (Ft^3/yr) 1970 - 141 tons

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Co 60	3.1 E6													
Ni 63	3.9 E5													
Sb 125	1.5 E4													
Others, entire spectrum of non-volatile fission products	--													
Total	5.7 E6													

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980*	New England	--
	Mid Atlantic	.30
	East North Central	.10
	West North Central	--
	South Atlantic	.60
	East South Central	--
	West South Central	--
	West	--
	Mountain	--

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TBW Profile Number	Production Quantity 198 1.5 E3 (a) (Ft^3/yr)	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨		1970 - 10 tons	
Am-243	8.6 E3												▨		
Cm-244	1.3 E6												▨		
Eu-154	2.8 E6												▨		
Sb-125	1.1 E6												▨		
Pm 147	1.4 E7												▨		
Eu 155	4.3 E5												▨		
Others: entire spectrum o nonvolatil	--												▨		
fission products													▨		
													▨		
Total	1.3 E8												▨		

*Continued on next page.

Commercial Nuclear Fuel Cycle - 1980 (Continued)

(a) A recently imposed regulation requires that in the future, liquid high-level wastes must be converted to an encapsulated, disposable, solid form within five years after reprocessing, and the solids must be shipped to a Federal repository within ten years after reprocessing for final disposal.[A-11]

A period of five years was assumed for storage of fission product wastes before solidification and shipment to a waste handling facility. The wastes that would be shipped (released) in 1980, therefore, would be the result of reprocessing of spent fuel in 1975. It was assumed that 760 MT of spent fuel was reprocessed in 1975 and two cubic feet of solidified waste result from the processing of one MT of LWR fuel.[A-12]

(b) Constituents were calculated assuming generation in 1975 and were based on the U-enriched Diablo Canyon nuclear reactor (burnup of 33,000 MWd/MT at 30 MW/MT with processing of .500 MT 150 days after discharge). Individual constituents were then assumed to decay for an additional five years before solidification and shipment (see note a).[A-12, A-13]

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 7e/Reprocessing Solid Hi-Level[A-10],[A-11]													New England -- Mid Atlantic .30 East North Central .10 West North Central -- South Atlantic .60 East South Central -- West South Central -- West -- Mountain -- Production Quantity 1980 1.5 E3 (a) (Ft^3/yr)	1970 - 10 tons	
Constituents															
Sr-90	3.4 E7														Storage/geologic containment
Ru-106	6.1 E6														
Cs-134	2.0 E7														
Cs-137	4.7 E7														
Ce-144	4.7 E6														
Pu-238	7.2 E3														
Pu-239	8.6 E2														
Pu-240	1.2 E3														
Pu-241	2.2 E5														
Am-241	8.6 E4														

WASTE STREAM

Current Production

Sheet USN-001 Radioactive Wastes from US Navy Part I

Constituent is Cobalt-60 Water

GEOGRAPHIC DISTRIBUTION

New England	.22
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	.56
East South Central	.04
West South Central	
West	.19
Mountain	

		BOOZ-ALLEN RATINGS													
		AIR			WATER			LAND							
Constituents	Concentration of Constituent in Stream (Ci/gal)	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	Production Quantity (Ci/yr.)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨		Data is for 1970	
Co-60 Portsmouth, NH	3E-8											.002	▨	Report NT-71-1 (BAAR Ap. 13)	Dilution
Groton,CT Co-60	1E-8											.004	▨	"	"
Newport News, VA	9E-9											.013	▨	"	"
Norfolk,VA	1E-8											.001	▨	"	"
Charleston, SC	2E-8											<.001	▨	"	"
Pascagoula, MS	1E-7											<.001	▨	"	"
San Diego, CA	1E-6											<.001	▨	"	"
Long Beach, CA	1E-6											<.001	▨	"	"
Vallejo, CA	2E-8											.002	▨	"	"
Bremerton, WA	7E-9											<.001	▨	"	"

WASTE STREAM	Concentration of Constituent in Stream (Ci/gal)	BOOZ-ALLEN RATINGS										Production Quantity (Ci/yr.)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Current Production Sheet USN-002 Radioactive Wastes from US Navy Part I Constituent is Cobalt-60 Water	▨											▨	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West 1.00 Mountain		
Constituents														Data is for 1970	
Pearl Harbor, HI	8E-9											< .001	▨	Report NT-71-1 (BAAR Ap. 13)	Dilution
Apra Harbor Guam	1E-6											< .001	▨	"	"
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
Total Discharge	9E-9											0.024		"	"

WASTE STREAM	Concentration of Constituent in Stream (Ci/gal)	BOOZ-ALLEN RATINGS										Production Quantity (Ci/yr)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Production Sheet USN-003 Radioactive Wastes from US Navy Part I Constituent is Cobalt-60 Water		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Constituents														Data is for 1970	
CO-60															
At Sea	6E-7											0.8		Report NT-71-1	Dilution

WASTE STREAM

Current Production

Sheet USN-004 Radioactive Wastes from US Navy Part I

Constituent is Cobalt-60 Resin

Constituents	Concentration of Constituent in Stream (Ci/ft³)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Production Quantity (Ci/yr)	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	Source of Data	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
														Data is for 1970	
At Sea	0.4											60		Report NT-71-1	Remote Location

WASTE STREAM

Current Production

Sheet USN-005 Radioactive Wastes from US Navy Part I

Constituent is Cobalt-60 Solid Waste

GEOGRAPHIC DISTRIBUTION	
New England	.08
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	.24
East South Central	.01
West South Central	
West	.68
Mountain	

Constituents	Concentration of Constituent in Stream (Ci/ft³)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Production Quantity (Ci/yr)	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
													Data is for 1970	
Portsmouth, NH	1E-3											16	Report NT-71-1 (BAAR Ap.1)	Shipped to USAEC for Burial
Groton, CT	1E-2											140	"	"
Newport News, VA	1E-2											312	"	"
Norfolk, VA	2E-2											146	"	"
Charleston, SC	7E-4											6	"	"
Pascagoula, MS	1E-3											<1	"	"
San Diego, CA	1E-3											1	"	"
Long Beach, CA	1E-3											<1	"	"
Vallejo, CA	2E-4											2	"	"
Bremerton, WA	7E-2											1327	"	"

WASTE STREAM	Concentration of Constituent in Stream (Ci/ft³)	BOOZ-ALLEN RATINGS AIR Human	 AIR Ecological	 AIR Explosion	 WATER Human	 WATER Ecological	 WATER Explosion	 LAND Human	 LAND Ecological	 LAND Explosion	Production Rating	Production Quantity (Ci/yr)	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Production Sheet USN-006 Radioactive Wastes from US Navy Part I Constituent is Cobalt-60 Soli	▨											▨		Data is for 1970	
Constituents													▨		
At sea Lat.20°54'N Long.161°06	3E-3											4.5	▨	Report NT-71-1 (BAAR Ap. 13)	At Sea in Remote Location
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream	BOOZ-ALLEN RATINGS										Production Quantity (Gals/yr)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Pro- duction BAAR-001Part I High Level Liquid Wastes Yearly 1977 Sr-90, Cs-137, Other		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic .86 East South Central West South Central West .17 Mountain .12		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Constituents															
Hanford,WA	?											1E5		BAAR TABLE A-12-23	Ultimately Solidification
Savannah River, GA	?											5E6		"	"
Idaho	?											7E5		"	"

WASTE STREAM

Current Production

ORNL-001
Non-Transuranic Solid Wastes for Surface Burial
Part II

GEOGRAPHIC DISTRIBUTION

New England	
Mid Atlantic	
East North Central	.17
West North Central	
South Atlantic	.10
East South Central	.07
West South Central	
West	
Mountain	.59

Constituents	Concentration of Constituent in Stream	BOOZ-ALLEN RATINGS AIR Human	Ecological	Explosion	WATER Human	Ecological	Explosion	LAND Human	Ecological	Explosion	Production Rating	Production Quantity (ft^3/yr)	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Rocky Flats	<10μCi/kg											1.5E5	ORNL-TM-3277 (Table 1.1) (Official Use Only)	Compaction, Burial
Mound	"											5E4	"	"
Savannah River	"											3E5	"	"
ORNL	"											2E5	"	"
Los Alamos	"											2E5	"	"
Other AEC	"											2E4	"	"

WASTE STREAM	Concentration of Constituent in Stream	BOOZ-ALLEN RATINGS										Production Quantity (ft³/yr)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Current Production ORNL-002 Transuranium Waste w/High Radiation Level or Large Size Part II Constituents are Pu239, Pu23 Am241, Cm244	▨											▨	New England Mid Atlantic East North Central West North Central South Atlantic .67 East South Central .33 West South Central West Mountain		
Constituents															
Rocky Flats	--											--	▨	ORNL-TM-3277 (Official Use Only)	Stored in Controlled Area
Mound	--											--	▨	"	"
Savannah River	--											1E4	▨	"	"
ORNL												5E3	▨	"	"
Los Alamos	--											--	▨	"	"
Other AEC	--											--	▨	"	"
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Production Quantity (ft^3/yr)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Production ORNL-003 Low Radiation Level Transuranium Waste Part II Constituents Pu239, Pu238, Am241, Cm244													New England Mid Atlantic East North Central .19 West North Central South Atlantic .13 East South Central .04 West South Central West Mountain .51		
Constituents															
	10,000 Ci/kg														
Rocky Flats	"											6E4		ORNL-TM-3277 (Official Use Only)	Stored in Metal Boxes or Drums
Mound	"											3E4		"	"
Savannah River	"											2E4		"	"
ORNL	"											7E3		"	"
Los Alamos	"											2E4		"	"
Other AEC	"											2E3		"	"

WASTE STREAM

Current Production

HAN-001 Hanford Radioactive Wastes (Liquid) during 1971

Part II

Pond Discharge

GEOGRAPHIC DISTRIBUTION

New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	
West	1.00
Mountain	

Total Volume = 6.3×10^{9} gal/yr

Constituents	Concentration of Constituent in Stream (Ci/gal)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Production Quantity (Ci/yr)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Plutonium	1E-8 G/Gal.										<	62 grams/yr.		ARH-2353, Part 3	Discharged to Ponds and Ditches
Beta curies	2E-9										<	15		"	"
Sr-90	8E-11										<	.5		"	"
Ru-106	7E-10										<	4.4		"	"
Cs-137	2E-10										<	1.3		"	"
Co-60	1E-10										<	.7		"	"
U-233	2E-8 G/Gal.										<	12G/year		"	"
Uranium	2E-8 kg/Gal										<	12kg/year		"	"

WASTE STREAM	Concentration of Constituent in Stream (Ci/Gal)	BOOZ-ALLEN RATINGS										Production Quantity (Ci/yr)	GEOGRAPHIC DISTRIBUTION		
Current Production HAN-002 Hanford Radioactive Liquid Wastes during 1971 Part II Crib Discharge		AIR			WATER			LAND					New England		Total Volume = 2.0X10^8 gallons/yr.
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	 1.00 	
	▨											▨		SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Constituents															
Plutonium	6E-6 G/Gal.											1180G/yr	▨	ARH-2353, Part 3	Discharged into Ground through Cribs
Beta Curies	3E5											5584	▨	"	"
Sr-90	3E-7											60	▨	"	"
Ru-106	2E-5											3800	▨	"	"
Cs-137 <	6E-7										<	116	▨	"	"
Co-60 <	4E-8										<	9	▨	"	"
U-233 <	4E-9										<	.9	▨	"	"
Uranium <	9E-8										<	18	▨	"	"
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream	BOOZ-ALLEN RATINGS: AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Production Quantity (g/yr)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Production HAN-003 Radioactive Liquid Wastes During 1971 Part II Plutonium Liquid Wastes	▨											▨	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West 1.00 Mountain	Total Volume= 2.3X10^5 gal/yr.	
Constituents															
Plutonium	.024G/Gal											553	▨	ARH-2353, Part 3	Discharged into Ground and Retained at Specific Retention Sites to Prevent Migration
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream	BOOZ-ALLEN RATINGS AIR Human	 AIR Ecological	 AIR Explosion	 WATER Human	 WATER Ecological	 WATER Explosion	 LAND Human	 LAND Ecological	 LAND Explosion	Production Rating	Production Quantity	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Production HAN-004 Radioactive Solid Wastes 1970-71 Part II	▨											▨	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West 1.00 Mountain	Total Volume: $5X10^8 ft^3$ Total Area: 150 acres	
Constituents															
Uranium	110 G/Ft^3											6E8 grams	▨	ARH-2353- Part 2	None. Direct Burial
Plutonium	.06 G/Ft^3											3E5 grams	▨	"	"
Beta Curies	13 Ci/ft^3											9E5 Ci	▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (Ci/Ft^3)	BOOZ-ALLEN RATINGS										Production Quantity (Ci/yr)	GEOGRAPHIC DISTRIBUTION	Total Volume = 4.3X10^{11}	Ft^3/yr
Current Production HAN-005 Radioactive Gaseous Wastes during 1971 Part II Offgas Air		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West 1.00 Mountain	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	▨			
Constituents															
Plutonium	1E-13											0.01	▨	ARH 2353, Part 2	Dilution
Uranium	3E-15											0.001	▨	"	"
Beta Curies	3E-12											1.4	▨	"	"
I-131	5E-13											0.2	▨	"	"
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (µCi/ml)	BOOZ-ALLEN RATINGS										Production Quantity (µCi/yr)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Production RFP-001 Rocky Flats Liquid Waste Part II		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain 1.00		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Constituents															
U + Pu	8.6E-9											50+3		WASH-1507, Part 15	Dilution
Gaseous	?											2.4E+3		WASH 1507, Part 16	"

WASTE STREAM	Pu Inventory, KG	BOOZ-ALLEN RATINGS										Total Quantity (ft³)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
Current Production BAAR-002 Total Solid Waste Inventory Alpha & Beta Present Accum. (1971) Part III Transuranics, Fission Prod;		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic East North Central .02 West North Central South Atlantic .23 East South Central .14 West South Central >.01 West .09 Mountain .31		
Constituents	▨											▨			
Hanford	644											1.5E+8*	▨	BAAR Table A.12.23 +Letter from Perge to Swift	Buried Onsite
Savannah River	25											3.7E+8	▨	"	"
Idaho	413											4E+	▨	"	"
LASL	4.8											2E+	▨	"	"
ORNL	8.3											2E+	▨	"	"
FMPC	?											3E+	▨	"	Placed in Pits
Y-12	?											3E+	▨	"	Buried Onsite
R. F.	?											2E+	▨	"	Shipped to AEC Site
SAN	?										<	1E+	▨	"	Buried Onsite
PANT	?											6E+1	▨	"	"

* Note that this number which includes Beta plus Alpha wastes is 50% higher than the alpha waste total on Sheets ORNL 004, 005, 006.

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
Current Production BAAR-00[illegible] Total Solid Waste Inventory Alpha & Beta Present Accum. (1971) Part III Trans, Fission Prod., Co-60	New England	
	Mid Atlantic	.04
	East North Central	.61
	West North Central	
	South Atlantic	
	East South Central	.11
	West South Central	
	West	.15
	Mountain	.08

Constituents	Total Inventory, KG	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Quantity (Ft^3)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
NTS	100 - 1000											2E+7		BAAR Table A.12.23	Buried Onsite
K2S	?											< 1E+7		"	"
PAD	?											2E+7		"	"
PORT	?											< 1E+7		"	"
Mound	?											1E+8		"	Shipped to commercial burial ground
BNL	?											< 1E+7		"	"
ANL	?											4E+7		"	"
BMI-C	?											< 1E+7		"	"
LRL-B	?											< 1E+7		"	"
LRL-L	?											3E+7		"	"

WASTE STR. NO.	Pu Inventory KG	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Quantity (Ft^3)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Production BAAR-004 Total Solid Waste Inventory Alpha & Beta Present Accum (1971) Part III Trans., Fission Prod., Co-60													New England Mid Atlantic .40 East North Central West North Central .10 South Atlantic East South Central West South Central West Mountain .40		
Constituents															
SNPO	?											2E4		BAAR Table A.12.23	Shipped to commercial burial site
BET	?											3E4		"	"
NB	?											< 1E4		"	"
Ames	?											< 1E4		"	"
PIN	?											< 1E4		"	Shipped to AEC Burial Site
LOV	?											2E4		"	Shipped to commercial burial site

WASTE STREAM

Current Production

ORNL-004
Trans. Wastes
Backlog of
Solid Wastes
Accumulation
Part III

Pu239, Pu238, Am241, Cm244

Alpha Intermediate Level Wastes ~ 100μCi/KG

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	.02
East North Central	
West North Central	
South Atlantic	
East South Central	.23
West South Central	
West	.71
Mountain	.02

Constituents		BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Quantity (Ft^3)	GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hanford	100μCi/kg											3E6		ORNL-TM-3277 (Official Use Only)	None, includes soils in which buried.
Savannah River	"											1E5		"	"
ORNL	"											1E6		"	"
Idaho	"											< 1E5		"	"

Total 4E6

WASTE STREAM
Current Production
ORNL-005
Trans. Wastes
Backlog of
Solid Wastes
Accumulation
Part III

High Concentration Alpha Wastes 10^4 μCi/kg

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	<.01
East North Central	
West North Central	
South Atlantic	
East South Central	.03
West South Central	
West	.97
Mountain	<.01

Constituents		BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Quantity (Ft^3)	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hanford	~10,000 μCi/kg											9E+7	ORNL-TM-3277 (Official Use Only)	Burial or Storage in Drums
Savannah River	"											1E+5	"	"
ORNL	"											3E+6	"	"
Idaho	"											< 1E+5	"	"

Total 9.3E7

WASTE STREAM

Current Production

ORNL-006
Trans. Wastes
Backlog of
Solid Wastes
Accumulation
Part III

Alpha Low-Level Wastes <10µCi/kg

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	.01
East North Central	
West North Central	
South Atlantic	
East South Central	.92
West South Central	
West	.06
Mountain	.02

Constituents		BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	Quantity	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hanford	<10µCi/kg											6E+6	ORNL-TM-3277 (Official Use Only)	Burial
Savannah River	"											8E+5	"	"
ORNL	"											1E+7	"	"
Idaho	"											2E+6	"	"

Total 1E7

WASTE STREAM		BOOZ-ALLEN RATINGS											GEOGRAPHIC DISTRIBUTION	SOURCE OF DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Current Production ARH-001 Hanford High Level Radioactive Wastes (Accumulation) Part III High level Waste Tanks		AIR			WATER			LAND				Quantity	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West 1.00 Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Total Volume	7E7 Gal	- Status 1/1/72											▨		
Solid Volume	2E7 Gal												▨	ARH-2400, Table 15	Storage, Solidification
Boiling Waste Tanks													▨	"	
Solid Vol.	7E5 Gal											7E5 Gal	▨	ARH-2400, Table 8	
Liquid Vol	6E6 Gal											6E6	▨		
Plutonium	.01g/gal											80 Kg	▨		
Sr-90	Classified Secret												▨	Data in ARH-2400, Secret Suppl.	
Cs-137	Classified Secret												▨	Data in ARH-2400, Secret Suppl.	
													▨		
													▨		

APPENDIX D

WASTE STREAM DATA SHEETS FOR WASTES WHICH QUALIFY AS HAZARDOUS UNDER THE WASTE STREAM DECISION MODEL

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
SIC 10, 20, 22, 26, 28, 33, 34 Waste Scavenging Catalyst		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
													Production Quantity		
Constituents															
Copper Chlorides	27% Sludge	2	2	2	2	3	1	2	2	2	1.0			Toxic to all forms of aquatic life	
Organics (diphenyl ether)	65% Sludge														

WASTE STREAM

SIC 10, 26, 28, 33, 34

TRW #8, p. 51

From Laboratories and Plants Using Lead

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION (New England, Mid Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, West, Mountain) Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead Carbonate		3	2	2	3	U	1	3	U	1	1.25	237		TLV 0.15 ppm cumulative poison	Add ammonium carbonate. Filter or settle to remove lead carbonate. Recycle or landfill.
Lead Acetate		3	2	2	3	3	1	3	2	2	1.25	234		" "	" "
Lead Nitrate		3	2	3	3	3	1	3	3	3	1.25	240		" " May explode when shocked.	

WASTE STREAM

SIC 22, 26, 28, 33

Refinery Waters

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	Ecological	Explosion	WATER Human	Ecological	Explosion	LAND Human	Ecological	Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead	20,000	3	2	2	3	U	1	1	U	2	1.5	233		Toxic and bioconcentrative	
Aluminum Chloride	300,000														Alkaline precipitation
Hydrochloric Acid	10,000	3	1	2	3	3	1	3	U	2	1.5				Neutralize

WASTE STREAM

SIC 22, 26,
28, 33

Refinery
Brines

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATFLY TREAT A CONSTITUENT
Lead	400- 600	3	2	2	3	U	1	1	U	2	1.5	233		Toxic and bioconcentrative	Concentrate and precipitate
Other Salts															

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 22, 28, 33 TRW #8, p. 26 Waste from Chlorinated Solvent Reclaiming Operations	▨											▨	Production Quantity		
Constituents													▨		
Sludge containing Chlorinated Hydrocarbons													▨	0.01 TLV for Chlorinated Hydrocarbons	Incineration with scrubbing
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM SIC 26 TRW #8, p. 51 From Manufacture of Lead Carbonate Paper	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR			WATER			LAND				TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Lead Carbonate		3	2	2	3	U	1	3	U	1	1.25	237		TLV 0.15 ppm cumulative poison	Add ammonium carbonate. Filter or allow precipitate to settle. Solubility of lead carbonate only 0.11 mg/l. Recycle or landfill.
Lead Acetate		3	2	2	3	3	1	3	2	2	1.25	234		" "	
Lead Nitrate		3	2	3	3	3	1	3	3	3	1.25	240		" " May explode when shocked	(The above is for all three constituents)

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 27 Printing Industry Sludges		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
	▨											▨	Production Quantity		
Constituents															
Lead	3,000-6,500	3	2	2	3U	1	1	U2			1.5	233	▨	Toxic and bioconcentrative	
Other Metals													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TLM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 28, 2818 TRW #4, p. 72 Dinitrophenol Production Wastes	▨											▨	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity		
Constituents															
Dinitrophenol		3	3	3	3	3	1	2	U		30.0	164	▨	TLV, 0.2 mg/m^3	(1) Return to manufacturer for recycle (for concentrated dinitrophenol)
													▨		(2) Incineration (for concentrated wastes)
													▨		(3) Discharge to a municipal sewer (for dilute wastes)
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 28, 2818

Chem. Ind.

Org. lign
Contem Metal
Benzene/Cumene

SIC 28
2818

Constituents	Concentration of Constituent in Stream (ppm)	BOOS-ALLEN RATINGS										TBW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Phenol	100,000 500,000	3	2	2	3	3	1	3	U	2	1.5			Drinking water limits .001 ppm Highly toxic to fish	
Benzene or Cumene	500,000 -900,000	2	U	3	2	U	2	1	U	3	1.0				

WASTE STREAM

SIC 2813

Fluorine Production Wastes

GEOGRAPHIC DISTRIBUTION

New England | Mid Atlantic | East North Central | West North Central | South Atlantic | East South Central | West South Central | West | Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hydrogen Fluoride		3	2	2	3	3	2	3U		3	1.5		▨	TLV 3 ppm. Causes burns. Max. drink water levels 0.8-1.7 mg/l people, 2.4 mg/l livestock	Lime and landfill resulting CuF2
Fluorine	Neg. Gas	3	3	2	3	3	1	3U		2	1.5	200	▨	TLV 0.1 ppm. High concentration of gas and the liquid will spontaneously ignite flammables	1) Burn in fluorine hydrocarbon air burner then scrub in caustic 2) React with charcoal bed
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM		BOOZ-ALLEN RATINGS											GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2815-2818 Cont. Intermediate Organic Ind. Chem. Prod. Ethylene via Thermal Pyrolysis	Concentration of Constituent in Stream (ppm)	AIR			WATER			LAND				TRW Profile Number	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity 1.9X10^6		
Constituents															
Phenols	0.1 #/ 1000 # Prod.	3	2	2	3	3	1	3	U	2	1.5			Drinking water limits .001 ppm Highly toxic to fish	
Organic Chlorides	0.02#/ 1000#														

WASTE STREAM

SIC 2818
Cumene Oxidation Process Phenol Prod. Wastes

GEOGRAPHIC DISTRIBUTION	
New England	--
Mid Atlantic	.56
East North Central	.13
West North Central	.13
South Atlantic	--
East South Central	--
West South Central	.15
West	.03
Mountain	--

Production Quantity
$37X10^6$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human			BOOZ-ALLEN RATINGS WATER Human			BOOZ-ALLEN RATINGS LAND Human				TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating			
Dichlorobenzene		2	2	1	2	1	3	2	2	U	1.25		Highly toxic to fish life	
Trichlorobenzene		2	1	U	2	1	3	1	1	1	1.25		" "	
Tar		3	U	2	3	U	1	3	U	1	1.5			

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2818, 2892 TRW #3, p. 91 Contaminated Tetranitromethane	▨											▨	Production Quantity		
Constituents													▨		
Tetranitromethane		3	3	3	3	U	1	3	U	3	1.0	428	▨	Explosive if exposed to heat or shock. TLV 1 ppm	Burning in modified enclosed pit with combustion products ~~scrubbed to remove oxides~~ of nitrogen and hydrogen cyanide
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2818, 2834
TRW #5 (V.2)
p. 323
Diphenylamine
Wastes - Pharmaceutical
Industries

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Diphenyl-amine		3	2	2	3	U	1	1	U	1	1.5	167		TLV, 10 mg/m^3	1) Incineration (conc. wastes) 2) Landfill (dilute wastes)

WASTE STREAM														GEOGRAPHIC DISTRIBUTION		
SIC 2818, 2821 Organic Chemical, Synthetic, Polymer Liquid (off-spec) Toluene Di isocyanate	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Toluene Di isocyanate	45-100%	3	1	2	3	U	1	3	U	1	1.0			12 ppm in air lethal to rats	
Toluene	0-55%	2	1	2	2	3	1	2	U	2	1.5			96 hr. TLm for mosquito-fish-1180 ppm	

WASTE STREAM

SIC 2818
TRW #3, p. 83
Off-grade
Maleic
Anhydride

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS: AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Maleic Anhydride		3	3	2	3	3	2	3	U	2	1.5	249	▨	TLV, 0.01 ppm/24 hrs. for concentrated material. Moderate fire hazard	Recycle or incinerate. Products of complete combustion are CO_2 and H_2O
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2818, 299

Petrochemical

Flake

Off-spec or
Waste Phenol

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phenol	Solid	3	2	2	3	3	1	3	U	2	1.5			Drinking water limits .001 ppm Highly toxic to fish	

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2818 Organic Chemical Organic Liquid Contaminated Nitrobenzene		AIR			WATER			LAND				New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	TRW Profile Number	Production Quantity		
Constituents															
Nitrobenzene	74%	3	2	3	3	3	1	3U	3	1.5	301		Max. allowable con. 1 ppm Acute aquatic toxicity-30 ppm	Incineration
Aniline	8%	3	1	2	3	2	1	3U	2	1.5				
Chlorobenzene	12%	2	1	2	2	3	1	1U	2	1.5				
Substituted Aryl Amine	6%													

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2818 Organic Chemical Solid Off-Spec or Overage Dinitrophenol		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Dinitro-phenol	85-100%	3	3	3	3	3	1	2	U	3	1.0	164		TLV, 0.2 mg/m^3	1) Return for reprocessing (concentrated streams)
Water	0-15%														2) Incinerate concentrated wastes

WASTE STREAM

SIC 2818
TRW #3, p. 83
Still Bottoms from Maleic Anhydride Manufacturers

		BOOZ-ALLEN RATINGS											GEOGRAPHIC DISTRIBUTION		
		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
Constituents	Concentration of Constituent in Stream (ppm)	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Maleic Acid													▨		Incineration products of complete combustion are CO_2 and H_2O, neutralize with caustic and oxidize biologically.
Tars													▨		Incineration products of complete combustion are CO_2 and H_2O.
Maleic Anhydride		3	3	2	3	3	2	3	U	2	1.5	249	▨	TLV, 0.01 ppm/24 hr for concentrated material. Dilute aqueous streams generally nontoxic. Moderate fire hazard	Maleic anhydride is easily hydrolyzed by water to maleic acid which can be neutralized with caustic. The neutralized solution is readily oxidized biologically.
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2818
TRW #6, p. 227
Wastes from Nfg. of Nitrochlorobenzene

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Meta-Nitrochlorobenzene		3	U	2	3	U	1	3	U	1	1.5	302		Cause poisoning similar to nitrobenzene. TLV 0.01 ppm	1) Incineration with scrubbing
Para-Nitrochlorobenzene		3	U	2	3	U	1	3	U	1	1.5	302		" "	" "

WASTE STREAM

SIC 2818

TRW #3, p. 43

Waste Stream from Acrolein Manufacture

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Acrolein	PPb	3	2	2	3	3	U	2	U	2	1.0	8		TLV 0.001 ppm/24 hrs. Lower explosive limits in air 218 vol. %. Upper explosive limits in air 31 vol.	Submerged combustion or neutralization and secondary treatment Incineration-concentrated solutions

WASTE STREAM

SIC 2819
TRW #5 (V.2), p. 335
Hydrogen Bromide Wastes

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hydrogen Bromide		3	2	U	3	2	U	3	2	U	1.0			TLV, 5 ppm	Recycling and reprocessing

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2819 TRW #6, p. 21 From Hydrogen Cyanide Production Wastes	▨											▨	Production Quantity		
Constituents													▨		
Hydrogen Cyanide		3	3	3	3	3	2	3	U	3	1.5	218	▨	TLV 11 mg/m^3. Protoplasmic poison, can be explosive. Hydro-cyanic acid (formed at low pH) is especially toxic	1) Incineration with scrubbing for NO_x
													▨		2) Scrub with Sodium or Potassium Hydroxide to form cyanide salt
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2819

Manufacturing Wastes from Ammonium Silicofluoride

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity		Alkaline hydrolysis
													▨		
Ammonium Silicofluoride	150,000												▨		Incineration with alkali scrubber
Fluoracetic Acid	20,000												▨	Highly corrosive and toxic	
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2819
TRW #8, p. 51
From the Manufacture of Lead Nitrate, Acetate and Carbonate

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead Carbonate		3	2	2	3	U	1	3	U	1	1.25	237		TLV 0.15 ppm. Cumulative poison	Add ammonium carbonate. Filter or allow to settle out. Solubility only 0.11 mg/l in H_2O @ 20°C. Recycle or landfill
Lead Acetate		3	2	2	3	3	1	3	2	2	1.25	234		TLV 0.15 ppm. Cumulative poison	" "
Lead Nitrate		3	2	3	3	3	1	3	3	3	1.25	240		TLV 0.15 ppm. Cumulative poison. May explode when shocked	" "

WASTE STREAM

SIC 2819,
2892

TRW #6, p.
243

From the
Manufacture
of Sodium
Azide

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	▨		
Sodium Azide		2	3	2	3	3	1	3	U	B	1.5	378	▨	High toxicity. LD50 for rats is 46 mg/kg. Moderate explosive hazard, but if combined with other heavy metals in solution can precipitate very sensitive compounds.	1) Chemical decomposition with scrubbing 2) Incineration with scrubbing
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2819 Ind. Inorg. Chem. Production Wastes Phosphorous	New England	--
	Mid Atlantic	--
	East North Central	--
	West North Central	--
	South Atlantic	.10
	East South Central	.48
	West South Central	
	West	
	Mountain	.42
	Production Quantity 21.4X10⁶ dry basis	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
White or Yellow Phosphorous 309	12#/ton Prod.	3	U	3	3	3	3	3	U	3	1.5	332		
Sodium Phosphate 371	10.5#/ton Prod.	U	2	2	3	U	1	2	U	1	1.5			
Sodium Fluoride 359	8#/ton Prod.	3	3	2	3	3	1	3	2	1	1.25	389	TLV 2.5 mg/m^3	Treat with lime landfill of solids

WASTE STREAM

SIC 2819
TRW #6, p. 25
Wastes from Fluoride Salt Production

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	 AIR Ecological	 AIR Explosion	 WATER Human	 WATER Ecological	 WATER Explosion	 LAND Human	 LAND Ecological	 LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Ammonium Fluoride		3	2	2	3	2	1	3	U	2	1.25	25		TLV for dusts 2.5 milligrams/ m^3. Commonly used as insecticides and rodenticides.	Continuous reaction with an excess of lime, followed by lagooning to allow solids
Ammonium Bifluoride														Dosages of 1.5-2 grams (expressed as F) are lethal.	to settle and recovery or landfill disposal of the precipitated calcium fluoride
Potassium Fluoride		3	2	2	3	1	1	3	U	2	1.5	346		The bifluorides hydrolyze to hydrofluoric acid. FWPCA recommends fluoride in	
Potassium Bifluoride														drinking water be limited to 0.8-1.7 mg/liter for humans	
Sodium Fluoride		3	3	2	3	3	1	3	2	1	1.25	389		and less than 2.4 mg/liter for livestock	
Sodium Bifluoride															
Hydrofluoric Acid		3	2	2	3	3	2	3	U	3	1.5			Causes burns on contacting skin, mucosa or eyes	

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2821 Cellulose Esters	New England	.10
	Mid Atlantic	.21
	East North Central	.21
	West North Central	.16
	South Atlantic	.14
	East South Central	.07
	West South Central	.10
	West	.02
	Mountain	--
	Production Quantity 14.4X10^9 gal	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Acetic Acid		2	1	2	2	3	1	2	2	U	1.5			
Sulfuric Acid		3	2	2	3	3	2	3	U	2	1.5			Neutralization
Mercury Chlorides		3	3	2	3	3	1	3	U	1	1	253	Bioaccumulative and toxic when methylated	
Methyl Methacryl-ate		2	U	2	1	2	1	2	U	1	1.5		" "	
Ethyl Cellosolve														

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2821 Vinyl Resins Vinyl Resins Manufacturing Wastes	New England	.11
	Mid Atlantic	.24
	East North Central	.02
	West North Central	.20
	South Atlantic	.19
	East South Central	.09
	West South Central	.11
	West	.03
	Mountain	--

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	Production Quantity 4.5X10^9	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Phenols		3	2	2	3	3	1	3	U	2	1.5		▨	Drinking water limits .001 ppm Highly toxic to fish	
Carbon Tet		3	1	2	3	2	1	2	U	2	1.5		▨		
Chloroform		3	2	2	1	3	2	1	U	2	1.5		▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2823 Rayon Production Rayon Fibers		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity 12-50X10^6		
Constituents															
Zinc Chloride		2	3	2	1	3	1	2	U	2	1.25				Concentrate and precipitate
Cuppramonium Rayon 1)Spinning Bathes and Copper	8000-16000	2	2	2	2	3	1	2	2	2	1.5				Concentrate and precipitate
Sulfuric Acid	12000-16000	3	2	2	3	3	2	3	U	2	1.5				Neutralization
2-Blue Waters Copper	80-200	2	2	2	2	3	1	2	2	2	1.5			Toxic to aquatic life forms	
Sulfuric Acid	750-12000	3	2	2	3	3	2	3	U	2	7.5				Neutralization
Ammonia	800	2	U	2	3	3	1	2	U	2	1.5				

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2841 Soap and Detergent Manufacture		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Nickel Sulfate	100 200	2	2	1	2	2	1	1	2	1	1.25	298		Toxic to fish life	Concentrate and precipitate
Sulfuric Acid	50,000 - 100,000	3	2	2	3	2	3	3	2	U	1.5				Neutralize
Zinc Sulfate	30,000														Concentrate and precipitate
Surfactant	trace														
Stannous Chloride	20,000	2	3	2	2	U	1	2	U	1	1.0				
Hydrochloric Acid	70,000	3	1	2	3	3	1	3	U	2	1.5				Neutralize

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2851 Paint Manufacture Sludge		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Lead Oxide	1.5% Sludge	3	2	2	3	U	1	3	U	2	1.25	242			Recycle or landfill.
Cleaners															
Resins															
Lead Carbonate		3	2	2	3	U	1	3	U	1	1.25	237		TLV 0.15 ppm. Cumulative poison.	Recycle and landfill.

WASTE STREAM

SIC 2892

TRW #8, p. 51

Manufacture of Matches and Pyrotechniques

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	West	Mountain	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Lead Carbonate		3	2	2	3	U	1	3	U	1	1.25	237										▨	TLV 0.15 ppm. Cumulative poison	Add ammonium carbonate; filter or settle to remove lead carbonate. Recycle or landfill.
Lead Acetate		3	2	2	3	3	1	3	2	2	1.25	234										▨	" "	" "
Lead Nitrate		3	3	2	3	3	1	3	3	3	1.25	240										▨	TLV 0.15 ppm. Cumulative poison. May explode when shocked	" "
Barium Carbonate		2	1	1	2	1	2	1	U	1	1.5	52										▨	TLV 0.5 mg/m^3. Toxic when ingested, MPC in drinking water 1 ppm	1) Precipitate as sulfate with sulfuric acid 2) ion exchange
																						▨	" "	3) Reverse osmosis 4) Adsorption on activated carbon
Barium Nitrate		2	U	2	2	2	1	1	U	2	1.0	471										▨	Nitrate is oxidizing agent	" "

WASTE STREAM

SIC 2892
Explosives

TNT-Red Water
Waste

GEOGRAPHIC DISTRIBUTION	
New England	--
Mid Atlantic	--
East North Central	--
West North Central	--
South Atlantic	.365
East South Central	--
West South Central	.635
West	--
Mountain	--

Production Quantity
$82X10^3$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TSM Profile Number	SPECIFIC HAZARD DATA (TLV, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Sulfite	2.3%	2	2	2	2	2	2	1	U	2	1.5			
Sodium Nitrite	3.5%	3	2	U	3	3	U	1	U	U	1.5			
Sodium Nitrate	1.7%	2	3	2	2	1	1	1	U	2	1.5			
Nitrotoluene	17.3%	2	U	2	2	3	1	2	U	2	1.25			
Dinitrotoluene		3	3	U	3	1	3	2	2	U	1.5	165	TLV 1.5 mg/m^3; explodes at 310°C in five sec.	Incinerate
Trinitrotoluene	340/1000 Prod.													
Acetic Acid	1600/ton Prod.	2	2	1	2	1	3	2	U	2	1.5			
HMX	20/100 ton Prod.													
TDX, PETN, TETRYL etc.														

WASTE STREAM																
SIC 29 Petrochemical Waste Liquid Off-Spec Isoprene	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TSM Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TSM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Isoprene	99-100%	2	2	1	2	3	1	2	U	2	1.5			Highly flammable	Incineration

WASTE STREAM

SIC 29

Petrochemical Wastes

Org. Tar Phenylamine Tar Wastes

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Diphenyl-amine tars	70-90%	3	2	2	3	U	1	1	U	1	1.25	167		TLV 10 mg/m^3	1) Incineration
Toluene	10-30%	2	1	2	2	3	1	2	U	2	1.5				

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 29 Petrochemical Other Wastes Continued	▨											▨	Production Quantity		
Constituents															
Ethyl Benzene	-	2	1	1	2	3	1	2	U	1	1.6		▨		
Ethylene Dichloride	-	3	2	2	3	3	1	3	U	2	1		▨	LO50 for rats-770 mg/Kg TLm for pinperch-150 ppm	
Ethylene Glycol	-	1	1	2	2	1	1	1	U	1	1.5		▨		
Ethylene Oxide	-	2	1	2	1	2	1	2	U	2	1.75		▨		
Formic Acid	-	3	2	2	3	1	1	2	1	1	1.25		▨		
Tar	-	3	U	2	3	U	1	3	U	1	1.5		▨		Incineration with scrubbing
Thallum	-	3	3	2	3	U	1	1	U	1	1	430	▨	Toxic metal	
Toluene	-	2	1	2	2	3	1	2	U	2	1.5		▨	96 hr TLm for mosquito-fish-1180 ppm	
Vinyl Acetate	-	1	3	2	1	3	1	1	U	1	1.5		▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 29 Petrochemical Other Wastes Continued		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Chloric Acid	NA	3	2	2	3	3	1	3	U	2	1.25			TLV, .1 mg/m^3. Very corrosive	1) ion exchange 2) adsorption on carbon 3) reduction to Cr, follow precipitation by DH
Nitric Acid	"	3	3	1	3	3	2	3	2	1	1.5				
Phosphoric Acid	"	2	U	2	2	3	1	2	U	1	1.5				
Sodium Hydroxide	"	2	1	2	2	3	2	3	U	2	1.5				

WASTE STREAM

SIC 291
Petroleum
Refining

Petroleum Refining Aldehydes Wastes

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	.11
East North Central	.18
West North Central	.07
South Atlantic	.03
East South Central	.03
West South Central	.50
West	.15
Mountain	.03
Production Quantity	$50X10^6$

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Acetaldehyde 1		2	3	2	2	3	1	2	2	2	1.5		96 hr TLm for sunfish-25 ppm	Incineration
Butyl Aldehyde 05		1	1	2	2	3	1	1	1	U	1			" "
Formaldehyde 199		3	2	2	3	3	1	3	U	2	1.5		250 ppm lethal to rate in air 96 hr TLm for catfish-25 ppm	" "
Furfural 201		2	2	2	2	3	1	2	U	1	1.5		96 hr TLm for bluegill-24 ppm	" "

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 291 Petro. Ref. Misc. Petroleum Refining Wastes		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Allyl Alcohol		2	3	2	2	3	1	2	U	2	1				
Amyl Alcohol		2	3	2	3	2	1	2	U	2	1.25				
Butanol		1	1	2	2	3	1	1	U	2	1.5				
Ethanol		2	1	2	2	1	1	1	U	2	1.5				
Isobutyl Alcohol		2	1	2	2	U	2	3	U	2	1				
Isopropyl Alcohol		2	1	2	2	2	1	1	U	2	1.5				
Methanol		2	2	2	3	2	1	2	U	2	1.5				
Benzene		2	1	2	2	3	1	2	U	2	1.5				
Butadiene		2	3	2	2	3	U	1	U	1	1.75				
Carbon Tetrachloride		3	1	2	3	2	1	2	U	2	1.5			Bioaccumulative	

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 291 Petroleum Refining Petroleum Refining Sour Waste	New England	
	Mid Atlantic	.01
	East North Central	.18
	West North Central	.07
	South Atlantic	.025
	East South Central	.025
	West South Central	.49
	West	.14
	Mountain	.06
	Production Quantity 683X10^9 Gal.	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Sulfides	NA	1	3	2	3	3	2	2	U	3	1.5			
Hydrogen Sulfide	NA	3	3	2	3	3	1	3	2	2	1.5	221	TLV-10 ppm Fatal @ 700-1,000 PPM in 30 min.	1) Numeration 2) Amine scrubbing 3) Class process 4) Activated Sludge
29 Ammonium Sulfide	NA	2	3	3	3	3	2	2	U	3	1.5			
Phenol	NA	3	2	2	3	3	1	3	U	2	1.5			
253 Mercury Mercaptans	NA	3	3	2	3	3	1	3	U	1	1			
Ethyl Mercaptans	NA	2	U	2	2	U	2	2	U	2	1	192	MAC-250 ppm	1) Incineration 2) Activated Carbon
Methyl Mercaptans	NA	2	2	2	2	3	2	2	U	2	1	272	MAC-50 ppm	
Acetic Acid	NA	2	1	2	2	3	1	2	2	U	1.5			
Cyanides 131	NA	3	U	2	3	U	2	2	U	2	1	129	TLV, 5 mg/m^3	1) Chlorination 2) Alkaline Oxidation
Nitrogen Bases	NA					NA								

WASTE STREAM														
SIC 291 Petroleum Refining Petroleum Refinery Spent Caustics	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	
		AIR			WATER			LAND					New England	
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Mid Atlantic	.09
													East North Central	.16
													West North Central	.06
													South Atlantic	.02
													East South Central	.03
													West South Central	.48
													West	.14
													Mountain	.02
											1-2 B bl	11	Production Quantity 5.X10^9	

Constituents	Concentration of Constituent in Stream (ppm)	Air Human	Air Ecological	Air Explosion	Water Human	Water Ecological	Water Explosion	Land Human	Land Ecological	Land Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Methyl Sulfate														
102 Dinitro o cresols		3	3	3	3	3	1	3	U	3	1.0	162	Highly toxic to mammals TLV 0.2 mg/m^3	1) Absorption on activated carbon 2) Activated Sludge 3) Eli Lilly patented process 4) Light catalyzed chlorine oxidation 5) Incineration
Mercaptans	1,500 -6,000	2	2	2	2	3	2	2	U	2	1.0			
Phenol	1,000 -2,000	3	2	2	3	1	3	3	2	U	1.5			
Lead	50 -1,000	3	2	2	3	U	1	1	U	2	1.5	233		Concentrate and precipitate
Sodium Hydroxide	65,000	2	1	2	2	3	2	3	U	2	1.5			Neutralize

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	Ecological	Explosion	WATER Human	Ecological	Explosion	LAND Human	Ecological	Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 321, 322, 323 Glass Etching Wastes													Production Quantity		
Constituents															
Hydrofluoric Acid	80, 000	3	2	3	3	13		3	2	U	1.			Max. drinking water limits 0.8-1.7 mg/l for people, <2.4 mg/l livestock. Burns eyes, skin, mucosa.	Lime and landfill CuF_2
Hydrochloric Acid	50, 000	3	2	1	3	13		3	2	U	1.				Neutralize
Alcohols	trace														
Silica	trace														

WASTE STREAM	
SIC 33, 3339 Nickel Ore Extraction	

GEOGRAPHIC DISTRIBUTION

New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	
West	
Mountain	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Nickel Sulfate	1,000-5,000	2	3	2	1	3	1	2	2	1	1.25	298			Concentrate and Precipitate
Sulfuric Acid	300,000	3	2	2	3	3	2	3	U	2	1.5				Neutralize
Isobutyl Ketone	10,000														
Hydrofluoric Acid	4,000	3	2	2	3	3	2	3	U	3	1.5			Max. drinking limits 0.8-1.7 mg/l <2.4 mg/l livestock. Burns skin, eyes, mucosa	Lime and landfill resulting CuF2

WASTE STREAM

SIC 33, 3317, 3399
Tube Manufacturing Manganese Wastes

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England	Mid Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	West	Mountain	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Hydroxide		2	1	2	2	2	3	2	3	U	1.5													Neutralize
Potassium per-manganate	70,000	3	3	2	3	3	1	3	U	2	1.5	349												Reduction/precipitate
Iron	[illegible]0,000																							Concentrate and precipitate
Copper	10,000	2	2	2	2	3	1	2	2	2	1.5												Toxic to aquatic life forms at low levels	Concentrate and precipitate

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 331, 3479 Metal Finishing Pickle Liquor	▨											▨	New England .02 Mid Atlantic .33 East North Central .45 West North Central .02 South Atlantic .02 East South Central .03 West South Central .05 West .03 Mountain .05 Production Quantity 218X10^9		
Constituents													▨		
Sulfuric Acid	40500# M$VA	3	2	2	3	3	2	3	U	2	1.5		▨	Highly corrosive	Neutralization
Hydrochloric Acid	1,700# M$VA	3	1	2	3	3	1	3	U	2	1.5		▨	" "	Neutralization
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 3315, 3357

Wire Drawing Waste

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	 AIR Ecological	 AIR Explosion	 WATER Human	 WATER Ecological	 WATER Explosion	 LAND Human	 LAND Ecological	 LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Copper	500	2	2	2	2	3	12	2	2	1.0					Concentrate/precipitate
Alkaline Wetting Oils															
Chromium	trace	3	2	2	3	3	13	U	2	1.25[11]				TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking water	Ion exchange, activated carbon, or chemical reduction and precipitate

WASTE STREAM	GEOGRAPHIC DISTRIBUTION
SIC 3331, 3351, 3362, 3399 Copper Tube Extruding Waste	New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Copper	40,000	3	2	2	3	3	1	3	3	1	1.0				Concentrate and precipitate
Nickel	200	2	2	1	2	2	1	1	2	1	1.25	289			Concentrate and precipitate
Hydrofluoric Acid-Nitric Acid	140,000	3	2	2	3	3	2	3	U	3	1.			Max. drinking water level 0.8-1.7 mg/l for people, <2.4 mg/l for livestock. Burns skin, eyes, mucosa	Lime and landfill CuF2

WASTE STREAM

SIC 3339

TRW #5 (V.2), p. 177

Antimony and Antimony Trioxide Wastes from Smelting Industry

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Antimony		3	2	2	3	U	1	2	U	2	1.25	33	▨	TLV, 0.5 mg/m^3 LD50, 100 mg/kg	The waste does not appear in a significant amount. Recycle
Antimony Trioxide		3	1	2	3	3	1	2	U	2	1.0	45	▨	TLV, 0.5 mg/m^3	is generally recommended. 1) Scrubbing
Antimony Pentoxide													▨	Similar to antimony trioxide LD50, 4,000 mg/kg	2) Cyclone
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 3339, 3399 Nickel Alloy Manufacturing Sludges		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Nickel Sulfate	4%	2	3	2	1	3	1	1	2	1	1.25	298			Concentrate and precipitate
Copper Sulfate	2%	2	2	2	2	3	1	2	2	2	1.0	122			Concentrate and precipitate
Sodium Fluoride		3	3	2	3	3	1	3	2	1	1.25	389		TLV 2.5 mg/m^3 dusts. Max. drinkwater limits 0.8-1.7 mg/l people, <2.4 mg/l livestock	Continuous liming and landfill of product CaF2.
Sodium Hydroxide		2	1	2	2	3	2	3	U	2	1.5				Neutralize

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity		
SIC 3351, 3352 Aluminum and Copper Rolling Mill															
Constituents															
Copper	30,000	2	2	2	2	3	1	2	2	2	1.0				Concentrate and precipitate
Chromium	trace	3	2	2	3	3	1	3	U	2	1.25	113		TLV 0.1 mg/m^3. Less than 0.05 ppm in drinking H_2O	Ion exchange, activated carbon, or chemical reduction and precipitate
Aluminum	trace														
Sulfuric Acid		3	2	2	3	2	3	3	2	U	1.5				Neutralize
Bichromate		3	U	1	3	3	1	3	U	1	1.5			TLV 0.1 mg/m^3	Reduction and precipitate

WASTE STREAM

SIC 3471
Acid Copper Plating Wastes

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
													▨		
Copper Sulfate	51,500	2	2	2	2	3	1	2	2	2	1.5	122	▨	Copper is toxic to all forms of aquatic life.	Concentrate and precipitate
Sulfuric Acid	13,000												▨		Neutralize
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 3471
Nickel Plating
Wastes

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	 AIR Ecological	 AIR Explosion	 WATER Human	 WATER Ecological	 WATER Explosion	 LAND Human	 LAND Ecological	 LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Nickel Chloride	82,000	2	3	2	1	3	1	2	3	1	1.0	294		Nickel is toxic to fish at low levels.	
Nickel Sulfate		2	3	2	1	3	1	2	3	1	1.25	298			

WASTE STREAM

SIC 3471

Pyrophosphate Copper Plating Wastes

GEOGRAPHIC DISTRIBUTION
- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Copper Pyrophosphate	30,00													Copper is highly toxic to fish.	
Sodium Pyrophosphate	210,00														

WASTE STREAM

SIC 3471

Tin Plating Wastes

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Stannic Chloride	53,000	3	U	1	3	U	2	3	U	2	1.0				
Stannous Chloride	-	2	3	2	2	U	1	2	U	1	1.0				
Hydrogen Fluoride		3	3	2	3	3	1	3	U	2	1.5			Burns skin. TLV 3 ppm. Max. drinking water levels 0.8-1.7	Lime and landfill product
														mg/1 for people, <2.4 mg/1 livestock	CuF_2

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 3471, 3479 Phosphate Sludges from Metal Coating Operations		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity $2X10^7$		
Constituents	Dry Basis														
Phosphates	51%														
Iron	20%														
Zinc	7.5%														
Sodium	3.5%	U	2	2	3	U	1	2	U	1	1.5				
Nickel	0.6%	2	2	1	2	2	1	1	2	1	1.25			Toxic to fish life	
Lead	0.5%	3	2	2	3	U	1	1	U	2	1.5			Bioconcentrative	
Calcium	.16%	U	U	2	U	U	1	U	U	2	1.5				
Manganese	.15%	3	U	2	1	U	1	1	U	1	1.0				
Hexane Solubles	3.5%														Incinerate

WASTE STREAM

SIC 3674

Semiconductor Manufacturing Wastes

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Boric Acid												60		Highly toxic to plants	

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 2a/Milling^{A-9} Gaseous *	▨											▨	New England -- Mid Atlantic -- East North Central -- West North Central <.05 South Atlantic -- East South Central -- West South Central 0.1 West <.05 Mountain 0.9 Production Quantity (lbs/yr) 1.3 E-4 (a)(b)(c)		
Constituents															
Rn-222$^{(c)}$	9.0 E3												▨		Existing: Dilution
Particulates (b)													▨		Filtration, precipitators, scrubbers
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
	9.0 E3												▨		

*Continued on next page.

2a/Milling Gaseous (Continued)

(a) Production quantity calculated solely from specific activity of Rn-222, i.e., does not include lbs/yr diluent (air).

(b) Production quantity does not include any airborne particulate wastes. To date, no information found concerning quantity and/or activity distribution of particulates in ventilation exhaust.

(c) *The actual distribution of the short-lived gas Radon ^{222} throughout the milling process is not known. However, for the purposes of this study, it is assumed that all of the Radon^{222} that is in secular equilibrium in the ore is released during the crushing and grinding operations and is exhausted to the air through the ventilation control system. The tabulated values do not include the continued releases of Radon from the tailing piles as the Radon continues to be found from the normal decay of the radium contained in the tailings.* A-[9]

Note: For additional bases and assumptions, see pages 1.5, 1.6, 2.4 and 2.5 of Reference A-[9].

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 2b/Milling Liquid*													New England	--		
													Mid Atlantic	--		
													East North Central	--		
													West North Central	<.05		
													South Atlantic	--		
													East South Central	--		
													West South Central	.10		
													West	<.05		
													Mountain	.90		
													Production Quantity 4.0 E9 (a)(b)(lbs/yr)			
Constituents																
U-238	9.6 E-1															Chemical precipitation[(b)]
Ra-226	2.0 E-2															
Th-230	1.6 E-1															
Others, Pb-210 Po-210	--															
Totals	1.1 E0															

*Continued on next page.

2b/Milling Liquid (Continued)

(a) Production quantity is that estimated for aqueous effluents from tailing ponds ($5.0x10^8$ gal/yr). About $7.0x10^8$ gal.[A-10] (1.5 Ci) was discharged in this manner in 1967. Most of the aqueous solutions discharged to tailing ponds are largely dissipated by evaporation or seepage. Recycle of clarified water with limitation of plant water intake to just offset evaporation and seepage could be used to reduce effluent.

(b) For additional bases and assumptions, see pages 1.5, 1.6, 2.4 and 2.5 of Reference A-9 .

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 2c/Milling^{A-9} Solid*	New England	--
	Mid Atlantic	--
	East North Central	--
	West North Central	<.05
	South Atlantic	--
	East South Central	--
	West South Central	.10
	West	<.05
	Mountain	.90
	Production Quantity 3.6 E10 (a)(lbs/yr)	

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
U-238	5.0 E2														Existing: Settling ponds; leveling and covering tailings piles with suitable earth and vegetation
Ru-226	9.0 E3														
Th-230	5.7 E3														
Pb-210	2.0 E3														
Po-210	2.0 E3														
Total	3.4 E4														

*Continued on next page.

2c/Milling   Solid (Continued)

(a) Production quantity based on estimated quantity of mill trailings in 1980.

> *The bulk of radioisotopes, other than uranium, that are contained in the original ore remain in the gangue which is stored in tailings piles... Tailings comprise an assortment of particle size ranging from slime to sand... Abandoned tailings piles are stabilized against wind and water erosion.*

Raffinate from the purification step and barren solution from the uranium precipitation step are chemically treated to precipitate the radioisotopes; precipitate also is discharged with gangue to tailings piles.

Note: For additional bases and assumptions, see pages 1.5, 1.6, 2.4, and 2.5 of Reference A-9.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 3b/U Conversion Liquid^{A-9}*													New England -- Mid Atlantic -- East North Central .60 West North Central -- South Atlantic -- East South Central -- West South Central .40 West -- Mountain --		
													Production Quantity 1980 1.0 E10 (a)(lbs/yr)	1970 total-1.5 tons solids & liquids	
Constituents															
U-238	0.7														Existing: Percolation through limestone beds, then to river, dilution
Others, Ra-226, Th-230	--														
Total	0.7														

*Continued on next page.

3b/U Conversion Liquid (Continued)

(a) Production quantity based on estimated quantity of off-gas scrubber solution being used in 1980 (∼3000 gal/min). Approximately 180 gal/min of off-gas scrubber solution was treated in 1967, i.e., discharged to waterways via limestone beds.[A-16]

Note: For additional bases and assumptions, see pages 151, 1.6, 3.3, and 3.4 of Reference A-9.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 3c/U Conversion SolidA-9*	▨											▨	New England -- Mid Atlantic -- East North Central .60 West North Central -- South Atlantic -- East South Central -- West South Central .40 West -- Mountain -- Production Quantity 1980 4.0 E4 (a)(lbs/yr)	1970 total-1.5 tons solids & liquids	
Constituents															
U-238	5.8												▨		Existing: Packaging and impoundment of liquids in limestone lined settling ponds
Ra-226	1.6												▨		
Th-230	4.6 E1												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
Total	5.3 E1												▨		

*Continued on next page.

3c/U Conversion Solid (Continued)

(a) In one commercial facility solid wastes, primarily contaminated inert fluidized bed material and ash from fluorination steps, are drummed and stored. Aqueous wastes are impounded. In a second commercial facility, raffinate from a solvent extraction purification step is impounded in limestone lined earthen ponds. Quantities of inerts and diluents associated with the above are unknown, therefore, production quantity calculated from specific activity of U-238.

Note: For additional bases and assumptions, see pages 1.5, 1.6, 3.3, and 3.4 of Reference A-9.

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 4a/U-Enrichment Gaseous A^{-3}*	New England	--
	Mid Atlantic	--
	East North Central	.20
	West North Central	--
	South Atlantic	--
	East South Central	.80
	West South Central	--
	West	--
	Mountain	--

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 1.5 E3 (a)(lbs/yr)	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
U-234	2.6 E-1												▨		Existing: Filtration/cold trapping of process vents
U-235	1.1 E-2												▨		
U-236	1.6 E-2												▨		
U-238	2.2 E-1												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
T0tal	5.3 E-1												▨		

*Continued on next page.

4a/U-Enrichment Gaseous (Continued)

(a) Airborne wastes containing uranium are those that leak from process equipment and escape exhaust air purification equipment. Quantity of diluent (air) is unknown; production quantity based on specific activity.

Note: For additional assumptions and bases, see pages 1.5, 1.6, 4.5, and 4.6 of Reference A-9.

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 4b/U-Enrichment Liquid A-**	New England	--
	Mid Atlantic	--
	East North Central	.20
	West North Central	--
	South Atlantic	--
	East South Central	.80
	West South Central	--
	West	--
	Mountain	--

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TBM Profile Number	Production Quantity 1.2 E4 (a) (lbs/yr)	SPECIFIC HAZARD DATA (TBM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
U-234	2.1 E0														Dilution, settling basin.
U-235	8.6 E-2														
U-236	1.3 E-1														
U-238	1.8 E0														
Total	4.1 E0														

*Continued on next page.

4b/U Enrichment Liquid (Continued)

(a) Liquid wastes arise from chemical recovery of uranium from incineration of combustibles, flushes of process equipment, and off-gas treatment and are discharged to the river after dilution and retention in a settling basin. Quantity discharged is unknown and production quantity was calculated from specific activity.

Note: For additional assumptions and bases, see pages 1.5, 1.6, 4.5, and 4.6 of Reference A-9.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 5a/Fuel Fabrication Gaseous A-9*													New England .10 Mid Atlantic .20 East North Central -- West North Central -- South Atlantic .30 East South Central .10 West South Central .10 West .20 Mountain --		
													Production Quantity 1.0 E3 (a) (lbs/yr)		
Constituents															
U-234	0.66														Existing: Filters, precipitators, glove box systems, dilution
U-235	0.03														
U-238	0.16														
Others, Pu isotopes (<630 μ Ci)	--														
Total	.85														

*Continued on the next page.

5a/Fuel Fabrication Gaseous (Continued)

(a) Production quantity calculated from specific activity, does not include lbs/yr diluent (air).

Note: For additional assumptions and bases, see pages 1.5, 1.6, and 5.1-5.9 of Reference A-9.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS										TBW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 5b/Fuel Fabrication Liquid^{A-3}*		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England .10 Mid Atlantic .20 East North Central -- West North Central -- South Atlantic .30 East South Central .10 West South Central .10 West .20 Mountain --		
	▨											▨	Production Quantity 3.5 E8 (a) (lbs/yr)		
Constituents															
U-234	1.6 E1												▨		Existing: Chemical precipitation, flocculation, settling basins, dilution
U-235	6.0 E-1												▨		
U-238	3.7 E0												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
Total	2.0 E1												▨		

*Continued on next page.

5b/Fuel Fabrication Liquid (Continued)

(a) Liquid wastes resulting from the fuel fabrication process are the treated streams resulting from UF6 conversion to UO_2, precipitation or calcination conversion of $Pu(NO_3)_4$ to PUO_2, from etching of fuel rods, scrubbing of off-gases and from non-process activities such as analytical operations, cleanup of glove boxes and process equipment, from labatories, showers, sinks, and etc. Production quantity was based on an estimated 8,000 gal/MT of liquid waste produced per MT[A-11] and 5,400 MT of fuel fabrication activity in 1980.

Note: For additional assumptions and bases, see pages 1.5, 1.6, and 5.1-5.9 of Reference A-9.

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 *6a/Irradiation Gaseous^{A-9}	New England	.10
	Mid Atlantic	.20
	East North Central	.20
	West North Central	<.05
	South Atlantic	.30
	East South Central	.10
	West South Central	<.05
	West	<.05
	Mountain	.10

Production Quantity 7.4 E-2 (a) (lbs/yr)

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
H-3	2.4 E3													Existing: Condensation of condensable vapors, holdup, filtration, dilution
N-13	6.9 E4													
Ar-41	1.1 E5													
Kr-85m, 85, 87,88	8.2 E6													
Xe-131,133m, 133,135m, 135, 138	1.2 E7													
Others C14, AR39;SR89,90; ZR95;NB95; MO99;	--													
RU103,106; TE132;CS134, 137;BA140;LA 140;CE141,144	--													
I-131,132, 133,135	2.9 E1													
Total	2.0 E7													

*Continued on next page.

(a) Production quantity calculated from specific activity, i.e., does not include lbs/yr diluent (air).

Note: For additional bases and assumptions, see pages 1.5, 1.6, and 6.3 of Reference A-9.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	 AIR Ecological	 AIR Explosion	 WATER Human	 WATER Ecological	 WATER Explosion	 LAND Human	 LAND Ecological	 LAND Explosion	 Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 6b/Fuel Irradiation Liquid^{A-3}*													New England .10 Mid Atlantic .20 East North Central .20 West North Central <.05 South Atlantic .30 East South Central .10 West South Central <.05 West <.05 Mountain .10		
													Production Quantity 1.8 E-1 (a) (lbs/yr)		
Constituents H-3	8.0 E5														Existing: Ion exchange, filtration, evaporation, dilution
Co-58,60	1.9 E1														
Sr-89	1.3 E0														
Mo-99	2.2 E2														
Ru-103,106	1.2 E2														
Te-132	1.5 E2														
I-131,132, 133,135	4.8 E2														
Cs-134,137	4.0 E0														
Others Cr51 Mu-54;Fe-55 59;Ni-63;Zr 95;Ba140;La140	--														
Total	8.0 E5														

*Continued on next page.

6b/Fuel Irradiation Liquid (Continued)

(a) Production quantity calculated from specific activity, i.e., does not include lbs/yr diluent (water). The effluent arises from the treatment of liquids resulting from coolant system leakage, contaminated drains, equipment decontamination, regeneration of ion exchange media, storage basins, chemical analysis, and miscellaneous activities. In 1971 it was noted that

> *...the liquid discharges (200,000 to about 6,000,000 gal/yr) are commonly diluted with the large volume (500,000 to 5,000,000 gal/min) of condenser cooling water from a 1,000* MW_e *reactor before discharge to the river.*[A-12]

Installed capacity projected for 1980 is about 150,000 MW_e.[A-14, A-15] Average effluent (cooling tower blowdown) from the Trojan Nuclear Power Plant is 8,700 gal/min.[A-13]

Note: For additional bases and assumptions, see pages 1.5, 1.6, and 6.3 of Reference A-9.

WASTE STREAM

Radioactive Wastes

Commercial Nuclear Fuel Cycle - 1980

7a/Reprocessing Gaseous *

GEOGRAPHIC DISTRIBUTION	
New England	--
Mid Atlantic	.30
East North Central	.10
West North Central	--
South Atlantic	.60
East South Central	--
West South Central	--
West	--
Mountain	--

Production Quantity 8.0 E9(a)(lbs/yr)

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
H-3	1.6 E6													Existing: Chemical scrubbing, high efficiency filters, iodine filters (silver reactor), and stock discharge.(b)
Kr-85(c)	2.5 E7													
Ru-103,106	9.4 E0													
Xe-131	7.4 E3													
I-131	3.7 E-1													
I-129(c)	2.3 E-2													
Sr-90	3.1 E0													
Cs-137	2.8 E-1													
Others: Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Ni-63, Sr-89, Zr-95, Nb-95m, Cs-134, Ba-140, La-140, Ce-141, Ce-144	--													
Total	2.7 E7													

*Continued on next page.

7a/Reprocessing Gaseous (Continued)

(a) In general, fuel reprocessing involves acid dissolution of spent fuel. Most of the volatile fission products are volatilized during this step. Currently, the noble gases are discharged to the atmosphere but greater than 99% of the radio iodine is removed. Off-gas streams are diluted with ventilation exhuast and production quantity was calculated from an estimated 240, 000 ft^3/min stack effluent.[A-9]

(b) Quantities of constituents were calculated by reducing information presented in Reference A-9 by a factor of 0.65. This was done to reflect current projections of fuel reprocessing requirements presented in Reference A-15.

(c) Proposed release requirements may require additional krypton removal and some improvement in iodine removal may be required if cooling time is reduced below about 200 days. Potential techniques for removal of krypton (and xenon) from reprocessing plant gaseous effluents include freon absorption, cryogenic distillation, low temperature carbon adsorption, room temperature carbon adsorption, carbon tectrachloride absorption, kerosene based solvent absorption, and the use of perma-selective membranes. In addition to caustic scrubbing and $AgNO_3$ impregnated adsorbers, potential iodine removal systems include HNO_3-Hg $(NO_3)_2$ scrubbing, concentrated HNO_3-Hg scrubbing, charcoal, and silver impregnated zeolites.[A-11]

Note: For additional bases and assumptions, see pages 1.5, 1.6, and 7.2-7.5 of Reference A-9.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 7b/Reprocessing Lo-Level Liquid (b)*													New England -- Mid Atlantic .30 East North Central .10 West North Central -- South Atlantic .60 East South Central -- West South Central -- West -- Mountain --		
	▨											▨	Production Quantity 2.7 E8 (a) (lbs/yr)		
Constituents													▨		
Others: I-129,Cr-51, Mn-54,Fe-55, Fe-59,Co-58 Co-60,Ni-63, Bu-140,La-140													▨		
Total	3.0X 10^4 (b)												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

*Continued on next page.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle - 1980 7b/Reprocessing Lo-Level Liquid (b)*	▨											▨	New England -- Mid Atlantic .30 East North Central .10 West North Central -- South Atlantic .60 East South Central -- West South Central -- West -- Mountain -- Production Quantity 2.7 E8 (a) (lbs/yr)		
Constituents															
H-3(c)	3.0 E4												▨		Existing: discharge of process condensates and miscellaneous liquid wastes through a system that includes interceptor tanks for analysis and diversion, a low level liquid waste treatment facility for removal of up to 99% of strontium and cesium isotopes, and a lagoon system with regulated discharge to water ways. (a)(b)D-3
Ru-103,106	1.7 E2												▨		
I-131	2.3 E-3												▨		
Sr-89	4.3 E0												▨		
Sr-90	4.3 E0												▨		
Zr-95	1.4 E1												▨		
Nb-95m	2.5 E1												▨		
Cs-134	1.1 E0												▨		
Cs-137	5.7 E-1												▨		
Ce-141,144	3.7 E0												▨		

*Continued on next page.

7/b Reprocessing Low-Level Liquid (b) (Continued)

(a) Production quantity was calculated from an estimated 3.2×10^7 gal/yr effluent, apparently from the NFS West Valley treatment and lagoon system.[A-1] However, Reference A-8 noted that the discharge rate at this plant is about 50,000 gal/day while average holdup time is one month. Only this facility will have an aqueous effluent stream containing significant amounts of radioactivity. The effluent arises from the distillation, ion exchange, and chemical treatment of process condensates, laundry wastes, decontamination operations, and floor drains.

(b) Quantities of constituents were calculated by reducing information presented in Reference A-1 by a factor of 0.65. This was done to reflect current projections of fuel reprocessing requirements presented in Reference A-7.

(c) Reference A-1 predicts that 4.6×10^4 Ci of tritium will be discharged with aqueous wastes in 1980. As a result of proposed release specifications, it appears that the NFS water discharge system may require further modifications to minimize the discharge of tritium. By 1980, alternatives include either recycle or volatilization and discharge via the stack.[A-3]

Note: For additional bases and assumptions, see pages 1.5, 1.6, and 7.2-7.5 of Reference A-1.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle 7c, (Cont'd.)*													New England	--	–	
													Mid Atlantic	.30		
													East North Central	.10		
													West North Central	--		
													South Atlantic	.60		
													East South Central	--		
													West South Central	--		
													West	--		
													Mountain	--		
	▨											▨	Production Quantity 80 E-5 (gal/yr)			
Constituents																
Pu-239	3.8 E3												▨			
Pu-240	5.3 E3												▨			
Pu-241	1.4 E6												▨			
Am-241	5.1 E5												▨			
Am-243	3.9 E4												▨			
Cm-242	6.1 E7												▨			
Cm-244	1.3 E7												▨			
Others: entire spectrum of non-volatile fission products													▨			
Total	6.6 E9												▨			

*Continued on next page.

WASTE STREAM	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Radioactive Wastes Commercial Nuclear Fuel Cycle 7c, (Cont'd.)*													New England -- Mid Atlantic .30 East North Central .10 West North Central -- South Atlantic .60 East South Central -- West South Central -- West -- Mountain --		
													Production Quantity 80 E5 (gal/yr)		
Constituents															
Cs-134	4.8 E8														
Cs-137	2.4 E8														
Pm-147	2.3 E8														
Ce-141	1.3 E8														
Ce-144	1.8 E9														
Sm-151	2.7 E6														
Eu-154	1.5 E7														
Eu-155	1.4 E7														
Gd-162	3.9 E5														
Pu-238	3.4 E4														

*Continued on next page.

WASTE STREAM

Radioactive Wastes

Commercial Nuclear Fuel Cycle - 1980

7c/Reprocessing High Level Liquid$^{D-6,D-}$

GEOGRAPHIC DISTRIBUTION

New England	--
Mid Atlantic	.30
East North Central	.10
West North Central	--
South Atlantic	.60
East South Central	--
West South Central	--
West	--
Mountain	--

Production Quantity
80 E5 (a)(gal/yr)

Constituents	Constituents in Stream (Ci/Yr)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sr-89 (b)	2.2 E8														Solidification followed by storage/geologic containment
Sr-90	1.8 E8														
Y-91	3.7 E8														
Zr-95	6.3 E8														
Nb-95	1.2 E9														
Ru-103	2.0 E8														
Ru-106	9.3 E8														
Ag-110m	5.9 E5														
Sn-119m	2.3 E4														
Sb-125	1.9 E7														

*Continued on next page.

7c/Reprocessing High Level Liquid[A-6, A-7] (Continued)

(a) About 99.9% of the nonvolatile fission products are removed in a high-level aqueous waste stream from the initial solvent extraction process. In general, the waste stream is an aqueous nitrate solution of metallic constituents (chemicals added during reprocessing and fission products). Production quantity was based on average fuel exposure of 33,000 MWD/MT, 2660 MT of spent fuel, and waste concentrated to 100 gal per 10,000 MWd(t).[A-6, A-7]

(b) Assumed 2,145 MT of U-enriched fuel and 113 MT of Pu enriched fuel.[A-7] For fission product distribution, however, calculated on the basis that all fuel associated with U-enriched Diablo Canyon nuclear reactor, burnup of 33,000 MWD/MT at 30 MW/MT, 150 day decay time.[A-6] The transuranic constituents used the following values for Ci/MT after 150 day decay. Assumed 0.5% of Pu in waste.

	U-enriched (Ci/MT)[A-6]	Pu-enriched (Ci/MT)[A-3]
Pu-238	2,810	8,950
Pu-239	330	573
Pu-240	478	778
Pu-241	115,000	358,000
Am-241	200	750
Am-243	17	28
Cm-242	15,000	165,000
Cm-244	2,490	67,500

APPENDIX E

WASTE STREAM DATA SHEETS FOR WASTES WHICH QUALIFY AS HAZARDOUS UNDER THE PURE COMPOUND APPROACH

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 22 Chromate Wastes from Textile Dyeing													New England .101 Mid Atlantic .178 East North Central .034 West North Central .005 South Atlantic .568 East South Central .034 West South Central .014 West .060 Mountain .006	A-3	Ref: TRW volume on waste p. 16 forms
	▨											▨	Production Quantity $2X10^7$ max		
Constituents															
Chromates												386	▨	Hexavalent chrome is carcinogenic.	
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C-1	Ref: Booz-Allen Table III-6 dry weight as chromates
SIC 2818 Ind. Org. Chem. Via N-Butane Dehydrogenation N-Butane Dehydrogenation Bertadiene Prod. Wastes	New England			
	Mid Atlantic			
	East North Central	.03		
	West North Central			
	South Atlantic			
	East South Central			
	West South Central	.92		
	West	.05		
	Mountain		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 3X10^5 Sludge	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chromic Sulfate	.07# 1,000# Prod.	3	2	2	3	3	1	3	3	1	1	486		TLV .5 ppm	1) Ion exchange 2) Sewer 3) Direct precipitation
Organic Chloride	6.3# 1,000# Prod.			N	A										
Sodium 373 Sulfides	.3# 1,000# Prod.	1	3	2	3	3	2	2	U	3	1.5				

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		C- 1	Ref: Booz-Allen Table III-6 dry weight as organic chlorides, 20,000 lbs chromium
SIC 2818 Ind. Org. Chem. Via Natural Oxid. Formaldehyde Prod. Wastes	New England			
	Mid Atlantic			
	East North Central	.02		
	West North Central			
	South Atlantic	.05		
	East South Central			
	West South Central	.93		
	West			
	Mountain		SPECIFIC HAZARD DATA (TSW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TSW Profile Number	Production Quantity 8X10^5 Sludge	SPECIFIC HAZARD DATA	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Chromic Sulfate	.00378 1,0008 Prod.	3	2	2	3	3	1	3	3	1	1	486		TLV 0.5 ppm	1) Ion exchange 2) Discharge to main sewer 3) Direct precipitation
Carbon Tetrachloride		3	1	2	3	2	1	2	U	2	1.5				
(Chloroform) richloro- eltrane	.168 1,0008 Prod.	3	2	2	1	3	2	1	U	2	1.5				
richloro- eltrane (Me- hylene hloride		1	2	1	2	2	1	2	U	2	1.5				

WASTE STREAM

SIC 2819 Ind. Inorg. Chem.

Cyanide Production Wastes

B-1

GEOGRAPHIC DISTRIBUTION	
New England	.007
Mid Atlantic	.101
East North Central	.166
West North Central	.075
South Atlantic	.147
East South Central	.207
West South Central	.147
West	.096
Mountain	.054

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	$2x10^{12}$ (all SIC 2819		NDS
													▨		
Sodium Cyanate	15,000												▨		
Sodium Cyanide	trace	3	3	2	3	3	2	2U	2		1.5	387	▨	TLV 5 mg/m^3	Alkaline oxidation by chlorination
Sodium Hypochlorite	trace												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

54-3000-469 (3-65)
AEC-RL RICHLAND WASH

WASTE STREAM

SIC 2819 Ind. Inorg. Chem.

Potassium Chromate Production Wastes

GEOGRAPHIC DISTRIBUTION	
New England	.19
Mid Atlantic	.06
East North Central	.015
West North Central	.005
South Atlantic	.60
East South Central	.10
West South Central	.01
West	.01
Mountain	.01

Production Quantity $1X10^6$

C-4

3% of Nat. Prod.

Ref.: Booz-Allen Table III-6 dry weight as chromates

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Potassium Chromate		3	3	1	3	3	1	3	3	1	1.5	343	TLV .1 mg/m^3	Reduction-precipitate Electro reduction
Potassium Dichromate		3	U	1	3	3	1	3	3	1	1.5	345		Reduction-precipitate Electro reduction

WASTE STREAM

SIC 2821
Plastics,
Resins and
Elastomers

Wastes from
Polycarbonate
Polymer Prod.

C-5

GEOGRAPHIC DISTRIBUTION	
New England	.046
Mid Atlantic	.121
East North Central	.101
West North Central	.018
South Atlantic	.404
East South Central	.182
West South Central	.101
West	.027
Mountain	-

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 2x10^{12} (all SIC 282)	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phosgene												101		TLV 1 ppm	1) Dilute to 1 ppm 2) Scrub with caustic 3) React with alcohols 4) Hydrolyze at elevated temp. with steam and NA_2CO_3 scrubbing

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 283 Drugs Organic Pharmaceutical Wastes	New England	.056
	Mid Atlantic	.348
	East North Central	.183
	West North Central	.089
	South Atlantic	.100
	East South Central	.033
	West South Central	.060
	West	.115
	Mountain	.011
	Production Quantity	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Dimethyl-Foramide															Incineration with caustic scrubbing
Methyethyl-Ketone		2	1	2	1	1	1	1	U	2	1.0				" "
Acetonitrile		2	2	2	2	2	2	1	U	2	1.5			Recommended drinking water limit .2 ppm	" "
Caustic		2	1	2	2	3	2	3	U	2	1.5				" "
Benzyl-chloride		3	U	2	3	3	2	3	U	2	1.25			Causes discomfort when present at 16 ppm	" "
Flurobenzoic Acid															" "
Dichlorobenzene		2	1	2	2	3	1	2	U	2	1.25			50 ppm has been lethal to fish.	" "
Trichlorobenzene		2	U	1	2	3	1	1	1	1	1.25			100 ppm can destroy aquatic microlife.	" "

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 287 Agric Chem. Ag. Chem. Mfg Wastes	New England	.005
	Mid Atlantic	.075
	East North Central	.145
	West North Central	.074
	South Atlantic	.299
	East South Central	.207
	West South Central	.090
	West	.058
	Mountain	.046

A-5

Production Quantity 1.9x10^{12} (all SIC287)

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hydrazine		3	3	2	3	1	3	3	3	U	1.0	212		TLV 1.3 mg/m^3 strong irritant. Flammable and hypergolic with some oxidants	1) Incineration 2) Catalytic decomposition 3) Dilute with water and allow bacterial action

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	C-4	Ref: Booz-Allen Table III-6 dry weight as urea, ammonia, and chromate
		AIR			WATER			LAND							
SIC 2873 Ag. Chem 287 Nitrogenous Fertilizer Urea Prod. Wastes		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic .05 East North Central .09 West North Central .18 South Atlantic .09 East South Central .15 West South Central .29 West .14 Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity $2X10^5$ dry bases		
Constituents													▨		
Urea	67#/ ton	1	U	1	1	1	1	1	U	1	1.5		▨		
Ammonia	18#/ ton	2	U	2	3	3	1	2	U	2	1.5		▨		
Sodium Chromate	41#/ 1000 ton	3	3	1	3	2	1	3	U	1	1.5	386	Neg.	TLV .1 mg/m^3	1) Reduction-precipitate 2) Electro reduction

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2873 Ag. Chem. Production Wastes Ammonium Sulfate	New England	
	Mid Atlantic	
	East North Central	.040
	West North Central	
	South Atlantic	
	East South Central	
	West South Central	
	West	
	Mountain	.96
	Production Quantity 1x10^3 (dry basis chromate)	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Chromate 357	35#/ 1,000T Prod.	3	3	1	3	2	1	3	U	1	1.5	386	TLV .1 mg/m^3	1) Reduction-precipitate 2) Electro reduction

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		B-1	Ref: Booz-Allen Table III-6 raw waste
SIC 331	New England	.03		
Cold Finishing	Mid Atlantic	.34		
Cold Finishing Wastes	East North Central	.43		
	West North Central	.01		
	South Atlantic	.07		
	East South Central	.02		
	West South Central	.05		
	West	.01	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	Mountain	.04		

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 5X10^9 gal		NDS
Sodium Cyanide	.025#	3	3	2	3	3	2	2	U	2	1.5	387		TLV 5 mg/m^3	Alkaline oxidation by chlorination
Ferrous Sulfate	4# ton	1	2	1	1	3	1	1	U	1	1.5				
Sodium Chromate	.5# ton	3	3	1	3	2	1	3	U	1	1.5	386	Prod. Data available	TLV 0.1 mg/m^3	Chemical reduction Precipitation
Zinc Chloride	1# ton	2	3	2	1	3	1	2	U	2	1.75				Conc/ppt
Chlorinated Solvents															

WASTE STREAM	GEOGRAPHIC DISTRIBUTION		A-3	Ref: TRW volume on waste forms
SIC 3555 Printing Mach. Graphic Arts - Photography Wastes (Grauve Leather Press. Plate Making)	New England	.06		
	Mid Atlantic	.19		
	East North Central	.20		
	West North Central	.08		
	South Atlantic	.15		
	East South Central	.06		
	West South Central	.09		
	West	.04		
	Mountain	.13	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 4X10^5	Specific Hazard Data	Processes
	▨											▨			
~~Ammonium~~ Chromate		3	U	2	3	2	1	3	U	2	1.25	21	▨	TLV 0.1 mg/m^3	1) Reduction-precipitate 2) Electro reduction
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

APPENDIX F

WASTE STREAM DATA SHEETS FOR WASTES WHICH DO NOT QUALIFY AS HAZARDOUS UNDER EITHER THE PURE COMPOUND APPROACH OR THE WASTE STREAM DECISION MODEL

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 22 TRW #4 P. 125 Textile Finishing Wastes (dyeing)															
Constituents															
Oxalic Acid		3	3	1	3	3	1	3	U	2	1.25	317		TLV, 1 mg/m^3 Oral LD, 1 g/kg	1) Neutralization and incineration 2) Activated sludge
															3) Biodegradable
Hydrogen Fluoride		3	2	2	3	3	2	3	U	3	1.5			Burns, TLV 3ppm, Max. drinking levels 0.8-1.7 mg/l for people, <2.4 mg/l for livestock	Lime and landfill resulting CaF2
Barium Compounds		2	2	1	3	3	2	1	U	1	1.0			Toxic when ingested. TLV 0.5 mg/m^3. Max. levels for drinking water, 1 ppm	1) Precipitate sulfate with sulfuric acid
															2) Ion exchange 3) Reverse osmosis
															4) Adsorption on carbon

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 221 23 Cotton Cotton Industry	New England	.07
	Mid Atlantic	.17
	East North Central	.02
	West North Central	.03
	South Atlantic	.60
	East South Central	.10
	West South Central	.0019
	West	.001
	Mountain	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 6.2X10^7 gal	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Caustic Soda	512	2	1	2	2	3	2	3	U	2	1.5				
Phosphoric Acid	12	2	U	2	2	3	1	2	U	1	1.5				Neutralize
Chromium	2	3	2	2	2	2	3	1	2	U	1.25	113		TLV 0.1 mg/m^3 (Cr+6) TLV 0.5 mg/m^3 (Cr+3)	(Cr+6) (1) Reduction-precipitate (2) Electro-reduction (Cr+3) (1) Ion exchange (2) Direct precipitation
Zinc	.7#/ 1,000#												1.5X10^6 lb		Concentrate-precipitate
Copper	3#/ 1,000#	2	2	2	2	3	1	2	2	2	1.5		6.048X10^6 lb		Concentrate-precipitate
Dyestuffs															
Detergents	100														

From Page 111-19 Booz Allen

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	70,000 gal/1,000 lb Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 222 Wool 223 From Raw Wool Industry Waste	▨											▨	New England .13 Mid Atlantic .13 East North Central .03 West North Central .004 South Atlantic .60 East South Central .10 West South Central .003 West .003 Mountain 1 Production Quantity $9.940X10^6$		
Constituents															
Acetic Acid	24	3	1	2	2	3	1	2	2	U	1.5		▨		
Sulfuric Acid	4	3	2	2	3	3	2	3	U	2	1.5		▨		Neutralization
Chromic Mordant $Na_2Cr_3O_7(+NH_4)_2SO_4$	8												▨	TLV 0.1 mg/m^3	1) Reduction-precipitate 2) Electro-reduction
Chrome $Na_2Cr_2O_7$	12	3	3	1	3	2	1	3	U	1	1.5	113	▨	TLV, 0.1 mg/m^3	1) Reduction-precipitate 2) Electro-reduction
Monochlorbenzene	4	2	1	2	2	3	1	1	U	2	1.5		▨		
Soaps and Detergents	150												▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 229 Orlon Orlon Industry	New England	.08
	Mid Atlantic	.19
	East North Central	.015
	West North Central	.003
	South Atlantic	.60
	East South Central	.10
	West South Central	.01
	West	.001
	Mountain	.001
	Production Quantity 18 VID^6	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	25,000/1,000 # Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Copper	50	2	2	2	2	1	3	2	2	2	1.5		▨		Concentrate-precipitate
(Carbolic Acid Phenols	150	3	2	2	3	3	1	3	U	2	1.5		▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM SIC 229 Polyester Industry	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
	▨											▨	Production Quantity		
Constituents													▨		
Trichloro-benzene		2	U	12		3	1	1	1		11.25		▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
SIC 28, 29 TRW #8 Oil Additive Manufacture		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
	▨											▨	Production Quantity		
Constituents													▨		
Phosphorous Pentasulfide		3	U	2	1	U	2	2	U	2	1.5	335	▨	TLV 1.0 mg/m^3 in air. On contact with water decomposes into phosphoric acid and hydrogen sulfide (TLV 10 ppm)	Decompose in water. Scrub to remove hydrogen sulfide
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

Rollins III GC

WASTE STREAM

SIC 28, 2818

Chem. Ind.
Waste

Phenol-Cumene
Wash Down
Residue

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

		BOOZ-ALLEN RATINGS													
		AIR			WATER			LAND							
Constituents	Concentration of Constituent in Stream (ppm)	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
Copper	5 to 50	2	2	2	2	3	1	2	2	2	1.5		▨		
Alkali	tr.												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM															
SIC 2818 TRW #5 (V.2) P. 170 Allyl Chloride Prod. Wastes	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents	▨											▨			
Allyl Chloride		3	U	2	3	1	1	3	U	1	1.0	15	▨		1) Incineration
													▨		*Not Candidate
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2818 Benzene Sulfanate Process Phenol Prod. Wastes	New England	--
	Mid Atlantic	--
	East North Central	.53
	West North Central	--
	South Atlantic	--
	East South Central	.47
	West South Central	--
	West	--
	Mountain	--
	Production Quantity 170X10^6	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	170X10^6		
Benzene		2	1	2	2	3	1	2	U	2	1.5		▨		
Sulfuric Acid		3	2	2	3	3	2	3	U	2	1.5		▨		Neutralization
Caustics		2	1	2	2	3	2	3	U	2	1.5		▨		Neutralization
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2818
Chlorinated
Benzene Process Phenol
Prod. Wastes

GEOGRAPHIC DISTRIBUTION	
New England	--
Mid Atlantic	.04
East North Central	.75
West North Central	--
South Atlantic	--
East South Central	.21
West South Central	--
West	--
Mountain	--
Production Quantity	▨

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨			
Phenol	180	3	2	2	3	1	3	3	2	U	1.5		▨		
Chlorinated Hydro-carbons													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2818 Ind. Org. Chem. Cyclohexane Oxidation Cyclohexane Oxidation Prod. Wastes for Adipic Acid		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Copper 126 Sulfate	.316/ 1000 # prod.	2	2	2	2	3	1	2	2	2	1.5	122			
Vanadium (cmpnd not listed)	.06 #/ 1000 # prod.														
Cobalt 121 Chloride	.001 #/ 1000 # prod.	1	3	2	1	3	1	2	3	1	1				

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2818 TRW #4 Page 64 Dinitrobenzene Production Wastes		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents	▨											▨			
Dinitrobenzene		3	U	3	3	3	2	3	U	2	1.0	163	▨	TRW recommendation, <0.01 mg/m^3 for a 24 hr. period	1) Incineration for a significant quantity of conc. dinitrobenzene
													▨		2) Biological waste water treatment for dilute dinitrobenzene wastes
													▨		
													▨		*Not Candidate
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM TRW #5 (V.2) p. 328 Ethylenimine Prod. Wastes SIC 2818	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
Constituents		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Ethyleni-mine		3	3	2	3	3	1	3	U	2	1.2	190			1) Polymerization and discharge to a municipal sewer
															2) Incineration
															*Not Candidate

WASTE STREAM															
Glycol Production Wastes Chlorohydrin Process SIC 2818															

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating 5.4 gm./lb. Prod.	TSM Profile Number	GEOGRAPHIC DISTRIBUTION New England / Mid Atlantic / East North Central / West North Central / South Atlantic / East South Central / West South Central / West / Mountain / Production Quantity	SPECIFIC HAZARD DATA (TSM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
															Solvent Extraction
Propylene or Ethylene Glycol	1200	1	1	2	2	1	1	1	U	1	1.5				
Propylene or Ethylene Oxide	60	2	1	2	1	2	1	2	U	2	1.5				
Ethylene Dichloride	16	3	1	2	3	2	1	2	U	2	1.5				
Propylene or Ethylene Chlorohydrin	350														
Dichloroethyl Ether	29	3	U	2	3	3	2	1	U	2	1.0				
Epichlorohydrin	70	3	2	2	3	3	1	3	U	2	1.5				

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TBM Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TBM, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
High Temperature Elastomer Prod. Wastes SIC 2818													Production Quantity		
Constituents															
Boric Acid												60			

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
TRW #5 (V.2) p. 340 Hydroquinone Prod. Wastes SIC 2818		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Hydroquinone		2	2	1	2	3	1	2	U	1	1.25	220		TLV, 2 mg/m^3	1) Activated Sludge Oxidation 2) Incineration
															*Not Candidate

WASTE STREAM

TRW #6 p. 97
SIC 2818
Manufacture of Organic Phosphorous Compounds from Halogenated Phosphorous Cmpd Drum and Tank Car Heels

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phosphorous Trichloride		3	U	2	3	3	2	3	U	2	1.5	336		TLV 3 mg/m^3. React violently with small amounts of water.	Add phosphoric acid and neutralize the mass with Sodium Carbonate and send diluted material to waste treatment plant.
Phosphorous Pentachloride		3	3	2	3	U	2	3	U	2	1.0	334		TLV 1 mg/m^3. React violently with small amounts of water.	
Phosphorous Oxychloride		3	U	2	3	U	2	3	U	2	1.25	333		TLV 0.1 ppm	"

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
TRW #5 (V.2) p. 246 Mercaptan Prod. Wastes SIC 2818		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Butyl Mercaptan		2	1	2	2	U	1	2	U	2	1.0	77		MAC (maximum allowable concentration) 10 ppm	1) Incineration (for large volume gaseous waste and liquid waste)
Ethyl Mercaptan		2	U	2	2	U	2	2	U	2	1.0	192		MAC, 250 ppm	2) Activated carbon scrubber (for small volume of gaseous wastes)
Methyl Mercaptan		2	2	2	2	3	2	2	U	2	1.5	272		MAC, 50 ppm	
															*Not Candidate

WASTE STREAM
SIC 2818 Ind. Org. Chem. Prod. Wastes via Oxychlorination for Ethylene Dichloride

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	.10
West South Central	.86
West	.04
Mountain	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 24.3X10^6	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Organic Chlorides	32#/ 1,000# Prod.	3	U	2	3	3	2	3	U	2	1.5	112	▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
TRW #5 (V.2) P. 385 Quinone Prod. Wastes SIC 2818		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
	▨											▨	Production Quantity		
Constituents															
Quinone		3	2	2	3	3	1	3	U	1	1.0	365	▨	TLV, 0.1 ppm (or 0.4 mg/m^3)	Incineration
													▨		*Not Candidate
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
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													▨		

WASTE STREAM

TRW #3 p. 83

Wash Water from Maleic Anhydride Containers, etc.

SIC 2818

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION: New England, Mid Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, West, Mountain; Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Maleic Anhydride		3	3	2	3	3	2	3	U	2	1.5	249		TLV, 0.01 ppm/24 hr. for conc. material. Dilute aqueous streams generally not toxic. Moderate fire hazard.	Maleic anhydride is easily hydrolyzed by water to maleic acid which can be neutralized with caustic. The neutralized solution is readily oxidized biologically.

WASTE STREAM

TRW #6 P. 75

Wastes from
Manufacture of
Benzyl Chloride

SIC 2818

GEOGRAPHIC DISTRIBUTION

- New England
- Mid Atlantic
- East North Central
- West North Central
- South Atlantic
- East South Central
- West South Central
- West
- Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Benzyl Chloride		3	U	2	3	3	2	3	U	2	1.25	58	▨	TLV, 0.01 ppm, Corrosive liquid undergoes Friedel-Crafts condensation reaction in presence of copper, aluminum, iron, zinc, etc., which may result in explosions	1) Incineration with scrubbing to remove hydrogen chloride from off-gas 2) Benzyl chloride in dilute aqueous waste streams decomposes to benzyl alcohol in hot water. The benzyl alcohol can be decomposed by secondary sewage treatment
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

TRW #4 P. 45

Bromine Wastes

SIC 2818

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Bromine	0.2 (air) 1 (water)	3	2	U	2	2	3	3	2	U	1.0	65	▨	TLV, 1 ppm	Return to the manufacturer for recovery
													▨		React bromine wastes with iron for ferrosoferric bromide which is decomposed by sodium carbonate to produce sodium bromide
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2819
Indust. Organic Chem.

Acetone Prod.
Waste via Cumene Process

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	.32
East North Central	.16
West North Central	
South Atlantic	
East South Central	.10
West South Central	.40
West	.20
Mountain	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TNW Profile Number	Production Quantity 2.5X10^6 lbs	SPECIFIC HAZARD DATA (TNW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
Phenol	24 lbs./1000 lb prod.	3	2	2	3	3	1	3	U	2	1.5				

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2819 Ind. Inorg. Chem. Phosphoric Acid (Wet Process)		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
	▨											▨	Production Quantity $8.2X10^9$		
Constituents													▨		
													▨		
Calcium Fluoride 100	68#/ ton Prod.	3	1	2	3	U	1	2	U	2	1.5		▨		Landfill disposal
Phosphoric Acid 307	1#/ton Prod.	2	U	2	2	3	1	2	U	1	1.5		▨		
Sodium Phosphate 371	45#/ ton Prod.	U	2	2	3	U	1	2	U	1	1.5		▨		
Iron Phosphate Sludge													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
SIC 2819 Ind. Inorg. Chem. Production Wastes Aluminum Chloride		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		New England Mid Atlantic .50 East North Central .50 West North Central South Atlantic East South Central West South Central West Mountain		
													Production Quantity $4X10^5$ dry basis		
Constituents															
Chlorine	8#/ ton	3	2	2	2	3	2	1	U	2	1.25	105		TLV 1 ppm	1) Water scrubbing and stripping 2) Alkaline scrubber
Hydrochloric Acid	8#/ ton	3	1	2	3	3	1	3	U	2	1.25				Neutralize

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2819 Inorg. Ind. Chem. Production Wastes Aluminum Sulfate		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
	▨											▨	Production Quantity		
Constituents													▨		
Sulfuric Acid 382	10#/ton Prod.	3	2	2	3	3	2	3	U	2	1.5		▨		Neutralize
Settling Pond Mud	350#/ton Prod.												▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2819 Inorg. Ind. Chem. Prod. Wastes and Hydrochloric													New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
	▨											▨	Production Quantity 74X10^6 dry basis		
Constituents													▨		
Hydrochloric Acid	41#/ ton Prod.	3	1	2	3	3	1	3	U	2	1.5		▨		Neutralize
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

SIC 2819
Inorg. Ind.
Chem.

Production
Wastes
Hydrofluoric
Acid

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Calcium Fluoride	NA	3	1	2	3	U	1	2	U	2	1.5				Landfill disposal
Phosphoric Acid	NA	2	U	2	2	3	1	2	U	1	1.5				

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TSW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TSW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2819 Ind. Inorg. Chem. Production Wastes Hydrogen Peroxide		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity $2.9X10^6$ dry basis		
Constituents															
Hydrogen Peroxide	400/ ton Prod.	3	2	3	3	3	1	3U	3	1.5					Hydrolyze

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TBW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
SIC 2819 Inorg. Ind. Chem. Production Wastes Nitric Acid		AIR			WATER			LAND					New England .03 Mid Atlantic .05 East North Central .19 West North Central .15 South Atlantic .15 East South Central .15 West South Central .15 West .01 Mountain .11		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
	▨											▨	Production Quantity 38X10^6 dry basis		
Constituents															
Nitric Acid	6#/ ton	3	3	1	3	3	2	3	2	1	1.5		▨		
Filter Acid													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
TRW #2 P. 45 Sodium and Sodium-Potassium Alloy Prod. Wastes SIC 2819	▨											▨			
Constituents															
Sodium		3	2	U	3	2	U	2	2	U	1.5		▨	TLV, 2 mg/m^3	The (Na, K)Cl waste is a neutral salt and decomposition in an abandoned mine poses no problems
													▨		
Sodium-Potassium		2	2	U	2	1	U	2	2	U	1.5	402	▨		*Not Candidate
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM

TRW #5 (V.2)
P. 377

Sodium and Potassium Oxides Prod. Wastes

SIC 2819

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Monoxide		2	2	1	3	3	2	3	U	2	1.5			TLV, 1 mg/m^3	Neutralization and Settling * Not Candidate
Sodium Peroxide		3	U	2	3	3	2	2	U	2	1.5	400			
Potassium Peroxide		2	U	2	2	3	2	2	U	2	1.5	350			

WASTE STREAM

TRW #5 (V.2)
P. 399

Strontium
Wastes

SIC 2819

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Strontium		2	U	2	2	U	2	2	U	2	1.25	410			*Not Candidate

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2819 Inorg. Ind. Chem. Sulfuric Acid	New England	.01
	Mid Atlantic	.15
	East North Central	.04
	West North Central	.20
	South Atlantic	.21
	East South Central	.12
	West South Central	.21
	West	.04
	Mountain	.02

Production Quantity $28X10^6$ dry basis

		BOOZ-ALLEN RATINGS												
		AIR			WATER			LAND						
Constituents	Concentration of Constituent in Stream (ppm)	Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨		
Neutralization Pond Settling	30#/ ton Prod.													
Filter Acids														
Sulfuric Acid	1#/ ton	3	2	2	3	3	2	3	U	2	1.5			Neutralize

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 282 Plastics, Resins 2821-Acrylics Acrylics	New England	.11
	Mid Atlantic	.23
	East North Central	.03
	West North Central	.22
	South Atlantic	.16
	East South Central	.10
	West South Central	.12
	West	.03
	Mountain	---
	Production Quantity $25.7X10^6$	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Acryloni-trile 12		2	3	2	3	3	1	1	U	2	1.5			
Formic Acid 200		3	2	2	3	1	1	2	1	1	1.25			
Vinyl Ace-tate 412		1	3	2	1	3	1	1	U	1	1.5			
Vinyl Chlo-ride 413		2	U	2	2	1	1	2	U	2	1.5			
Styrene 379		2	1	2	2	3	1	2	U	1	1.5			

WASTE STREAM

TRW #8 P. 89

Waste from Manufacture of Phosphorous Pentasulfide

SIC 2819

GEOGRAPHIC DISTRIBUTION

New England
Mid Atlantic
East North Central
West North Central
South Atlantic
East South Central
West South Central
West
Mountain

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Phosphorous Pentasul-fide		3	U	2	1	U	2	2	U	2	1.5	335		TLV 1.0 mg/m^3 in air. On contact with water decomposes into phosphoric acid and Hydrogen Sulfide (TLV 10 ppm)	Decompose in water. Scrub to remove hydrogen sulfide

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
TRW #8 P. 89 Waste from Manufacture of Phosphorous Pentasulfide SIC 2819		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Phosphorous Pentasulfide		3	U	2	1	U	2	2	U	2	1.5	335		TLV 1.0 mg/m^3 in air. On contact with water decomposes into phosphoric acid and Hydrogen Sulfide (TLV 10 ppm)	Decompose in water. Scrub to remove hydrogen sulfide

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2821 Alkyd and Polymer Resins	New England	.13
	Mid Atlantic	.23
	East North Central	.03
	West North Central	.20
	South Atlantic	.17
	East South Central	.08
	West South Central	.12
	West	.04
	Mountain	---

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TBW Profile Number	Production Quantity 2.27X10^9	SPECIFIC HAZARD DATA (TBW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Maleic Anhydride 242	NA	3	3	2	3	3	2	3	U	2	1.5	249		TLV 0.01 ppm/24 hrs. Dilute aqueous streams nontoxic	Hydrolysis-neutralization with caustic. Neutralized sol. is bio-degradable
Styrene 379	NA	2	1	2	2	3	1	2	U	1	1.5				
Propylene Glycol 336	NA	1	1	2	1	1	1	1	U	1	1.5				
Phthalic Acid 314	NA	1	2	1	1	3	1	1	U	1	1.5				

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS											TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
TRW #5 (V.2) p. 318 Dinitrotoluene Wastes from Polyurethane Production SIC 2821		AIR			WATER			LAND						New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion		Production Rating		Production Quantity		
Constituents																
Dinitro-toluene		3	U	3	3	3	1	2	U	U	2	1.5	165		TLV, 1.5 mg/m^3 Explosion @ 310°C. in 5 seconds	Incineration
																*Not Candidate

WASTE STREAM

SIC 2821

Phenolic
Resins

GEOGRAPHIC DISTRIBUTION	
New England	.10
Mid Atlantic	.26
East North Central	.02
West North Central	.18
South Atlantic	.21
East South Central	.10
West South Central	.10
West	.03
Mountain	---

Production Quantity $100X10^6$ gal

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
305 Phenols	NA	3	2	2	3	3	1	3	U	2	1.5			
199 Formaldehyde		3	2	37% El. 2	3	3	1	3	U	2	1.5			

GEOGRAPHIC DISTRIBUTION	
New England	.14
Mid Atlantic	.25
East North Central	.03
West North Central	.22
South Atlantic	.19
East South Central	.11
West South Central	.04
West	.02
Mountain	--

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
SIC 2821 Polystyrene Resins and Copolymers	▨										115 gal	▨	Production Quantity 4.3X10^{9} gal		
Constituents													▨		
Methyl Amyl Alcohol 259		3	2	2	3	2	1	3	U	1	1		▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 2821	New England	.13
Urea and Melamine Resins	Mid Atlantic	.28
	East North Central	.03
	West North Central	.19
	South Atlantic	.19
	East South Central	.09
	West South Central	.09
	West	---
	Mountain	---
	Production Quantity 60X10^6 gal	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number		SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Hydroxide 363		2	1	2	2	3	2	3	U	2	1.5				
Ammonia		2	U	2	3	3	1	2	U	2	1.5				

WASTE STREAM														
Metal Wastes from Rubber Production SIC 2822	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	GEOGRAPHIC DISTRIBUTION New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
	▨											▨	Production Quantity		
Constituents													▨		
Nelsal	1,000-1,500												▨		
Styrene	20-40	2	1	2	2	3	1	2	UL		1.5		▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Viscose Rayon SIC 2823		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Carbon Di-sulfide	194	3	2	2	3	3	1	2	U	2	1.5				
Hydrogen Sulfide	53	3	3	2	3	3	1	3	2	2	1.5	221		TLV 10 ppm Fatal at 700-1000 ppm in 30 minutes	1) Numeration 2) Amine scrubbing 3) Class process 4) Activated Sludge

WASTE STREAM

SIC 287
Ag-Chem

Production
Wastes
Ammonium
Nitrate

GEOGRAPHIC DISTRIBUTION	
New England	.02
Mid Atlantic	.045
East North Central	.27
West North Central	.14
South Atlantic	.125
East South Central	.125
West South Central	.15
West	.125
Mountain	--

Production Quantity
164X10^6 dry basis

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	Ecological	Explosion	WATER Human	Ecological	Explosion	LAND Human	Ecological	Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Ammonia	5#/ ton	2	U	2	3	3	1	2	U	2	1.5			
Ammonium Nitrate	14#/ ton	1	U	2	1	2	1	1	U	3	1.5			

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Magnesium Alloys Hardened Steels SIC 33		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		
Constituents															
Barium Chloride		2	2	1	3	3	2	1	U	1	1.0	53	▨	TLV 0.5 mg/m^3 toxic when ingested. MPC in drinking water 1.0 ppm	1) Ppt. as sulfate with sulfuric acid 2) ion exchange
													▨		3) reverse osmosis 4) Adsorption or activated carbon
Sodium Fluorides		3	3	2	3	3	1	3	2	1	1.2	389	▨	TLV 2.5 mg/m^3 Rec. drink-water max. 0.8-1.7 mg/l for	Continuous liming with landfill of product CuF_2
													▨	people <2.4 mg/l for livestock	
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	
TRW #8 P. 69 Wastes from Manganese Production SIC 33, 3339	

GEOGRAPHIC DISTRIBUTION	
New England	
Mid Atlantic	
East North Central	
West North Central	
South Atlantic	
East South Central	
West South Central	
West	
Mountain	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Manganese		3	U	2	1	U	1	1	U1		1.0	499		TLV 5 mg/m^3	Landfill or lagooning O.K.
Manganese Chloride		3	3	2	3	2	1	1	U1		1.0	601		TLV 5 mg/m^3	" " " "
Manganese Sulfate												252		TLV 5 mg/m^3	" " " "

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
SIC 331 Pickling - Rinse Water	New England	.029
	Mid Atlantic	.329
	East North Central	.414
	West North Central	.014
	South Atlantic	.078
	East South Central	.021
	West South Central	.057
	West	.010
	Mountain	.047
	Production Quantity 500 gals/ton product	

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hydrochloric Acid 212	2.5#/ ton	3	1	2	3	3	1	3	U2		1.5		Highly corrosive	Neutralize
Sulfuric Acid 382	2.5#/ ton	3	2	2	3	3	2	3	U2		1.5		Highly corrosive	Neutralize

WASTE STREAM

SIC 331

Pickling -
Rinse Water

GEOGRAPHIC DISTRIBUTION	
New England	.029
Mid Atlantic	.329
East North Central	.414
West North Central	.014
South Atlantic	.078
East South Central	.021
West South Central	.057
West	.010
Mountain	.047

Production Quantity
500 gals/ton product

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Hydrochloric Acid 212	2.5#/ ton	3	1	2	3	3	1	3	U2		1.5		Highly corrosive	Neutralize
Sulfuric Acid 382	2.5#/ ton	3	2	2	3	3	2	3	U2		1.5		Highly corrosive	Neutralize

WASTE STREAM

SIC
333 Non-Ferrous
3334 Aluminum

Aluminum Plate and Sheeting Wastes

GEOGRAPHIC DISTRIBUTION	
New England	.06
Mid Atlantic	.02
East North Central	.22
West North Central	.01
South Atlantic	.20
East South Central	.04
West South Central	.20
West	.01
Mountain	.24

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number		SPECIFIC HAZARD DATA (THW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND							
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating				
	▨											▨	Production Quantity 5X10^6		
													▨		
Aluminum Phosphates	1.5#/ 1000# Al.		NA										▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		
													▨		

WASTE STREAM	GEOGRAPHIC DISTRIBUTION	
333 Nonferrous Metals 3334-Aluminum Aluminum Primary Smelting Waste	New England	.067
	Mid Atlantic	.020
	East North Central	.220
	West North Central	.010
	South Atlantic	.200
	East South Central	.033
	West South Central	.200
	West	.007
	Mountain	.240

Constituents	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS AIR Human	AIR Ecological	AIR Explosion	WATER Human	WATER Ecological	WATER Explosion	LAND Human	LAND Ecological	LAND Explosion	Production Rating	TRW Profile Number	Production Quantity 30X10^6 lbs	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
Sodium Fluoride	3#/ 1,000# al.	3	3	2	3	3	1	3	2	1	1.25	389		TLV 2.5 mg/m^3 for dusts. 0.8-1.7 mg/l in drinking water.	Continuous liming with landfill resulting CaF2
														<2.4 mg/l for livestock	

WASTE STREAM	Concentration of Constituent in Stream (ppm)	BOOZ-ALLEN RATINGS										TRW Profile Number	GEOGRAPHIC DISTRIBUTION	SPECIFIC HAZARD DATA (TRW, etc.)	PROCESSES WHICH ADEQUATELY TREAT A CONSTITUENT
		AIR			WATER			LAND					New England Mid Atlantic East North Central West North Central South Atlantic East South Central West South Central West Mountain		
		Human	Ecological	Explosion	Human	Ecological	Explosion	Human	Ecological	Explosion	Production Rating		Production Quantity		3.4X10^6 gal/day discharged by Intalco Alum. Seattle, Wa. to ocean
Aluminum Manufacturing SIC 3334, 3352, 3361															
Constituents															
Tars	1														
Fluorides	119	3	3	2	3	3	1	32	1	1.25				TLV 2.5 mg/m^3 dusts. Max. 0.8-1.7 mg/l in drinking water. <2.4 mg/l for livestock	Continuous liming with landfill resulting CuF2
Acid Dust	123														Neutralize
Alumina	26														
Sulfur	70	1	1	1	1	1	1	11	U	1.5					

APPENDIX G

ESTIMATED VOLUME AND COMPOSITION DATA OF 17 CATEGORIES OF WASTE STREAMS PROCESSED BY THE MEDIUM SIZED MODEL FACILITY

Wastes received at the model processing facility are segregated into 17 categories for treatment. Each of these categories represents either one specific waste or a blend of several wastes having similar characteristics. The volume and composition of the wastes in each of the categories are given in Tables A-2 through A-19. These data are based on the estimated compositions and volumes of hazardous wastes being generally received by currently established waste disposal firms.[A-16] As such, the compositions and volumes are not intended to represent true averages of what might be processed with strict enforcement of new pollution control regulations. Currently available information on the compositions and quantities of potentially hazardous wastes discharged in the United States is inadequate for accurate definition of the average waste composition and volume data for a typical processing facility.

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TABLE A-2

A-1 CONCENTRATED SULFURIC ACID SOLUTIONS

Estimated Volume: 2,000 gallons per day

Concentration: 70% H_2SO_4 average; Range 30-98%

Other Constituents	Average Concentration (%)	Range (%)
Hydrofluoric acid	0.5	0-1
Hydrochloric acid	0.5	0-1
Nitric acid	0.5	0-1
Heavy metals	1.0	0.5-5
Soluble organics	1.0	0-10

TABLE A-3

A-2 CONCENTRATED MIXED ACIDS

Estimated Volume: 2,000 gallons per day

Estimated composition as follows:

Constituents	Average Concentration (%)	Range (%)
Hydrochloric acid	10.0	5-20
Nitric acid	1.0	0-2
Sulfuric acid	10.0	5-20
Phosphoric acid	2.0	0-10
Hydrofluoric acid	1.0	0-5
Heavy metals	0.5	0.1-2
Soluble organics	0.5	0-1

TABLE A-4

A-3 DILUTE ACID SOLUTIONS CONTAINING CHROMIUM AND/OR OTHER OXIDANTS

Estimated Volume: 28,000 gallons per day

Estimated composition as follows:

Constituent	Average Concentration (%)	Range (%)
Cr^{+6}	4.0	0.1-15
As^{+5}	1.0	0-3
Mn^{+7}	0.5	0-7
H_2SO_4	10.0	5-20
H Cl	2.0	0-5
HF	1.0	0-10
Aluminum (+3)	3.0	0-15
Nickel (+2)	0.5	0-1
Lead (+2)	0.5	0-1
Zinc (+2)	0.5	0-10
Copper (+2)	1.0	0-10
Iron (+3)	1.0	0.1-5
Cadmium (+2)	0.1	0-0.2
Soluble organics	0.5	0-1

TABLE A-5

A-4 DILUTE ACID SOLUTIONS CONTAINING HEAVY METALS (NO CHROMIUM NOR AMMONIA)

Estimated Volume: 15,000 gallons per day

Estimated composition as follows:

Constituent	Average Concentration (%)	Range (%)
Nickel (+2)	3.0	0-6
Manganese (+4)	0.5	0-1
Copper (+2)	3.0	0-15
Arsenic (+3)	1.0	0-2
Antimony (+3)	1.0	0-2
Lead (+2)	1.0	0-2
Mercury (+2)	0.1	0-2
Cadmium (+2)	1.0	0-4
Aluminum (+3)	3.0	0-5
Zinc (+2)	4.0	0-10
Iron (+2,+3)	10.0	1-20
Tin (+2)	0.1	0-0.2
Selenium (+4)	0.1	0-0.2
Hydrochloric acid	5.0	0-20
Sulfuric acid	5.0	0-30
Nitric acid	1.0	0-2
Phosphoric acid	1.0	0-20
Soluble organics	0.5	0-1

TABLE A-6

A-5 DILUTE ACID SOLUTIONS CONTAINING HEAVY METALS AND AMMONIUM SALTS

Estimated Volume: 10,000 gallons per day

The average blended composition is expected to be similar to A-3 except for the following:

Constituent	Average Concentration (%)	Range (%)
NH_3	5.0	2-10
Cr^{+6}	0.1	traces-1
Persulfate	0.5	0-5

TABLE A-7

A-6 ACIDIC NITRATE SOLUTIONS CONTAINING HEAVY METALS

Estimated Volume: 6,000 gallons per day

The average blended composition is expected to be similar to that of A-4 except for the following:

Constituent	Average Concentration (%)	Range (%)
Nitric acid	15	10-20

TABLE A-6

A-5 DILUTE ACID SOLUTIONS CONTAINING HEAVY METALS AND AMMONIUM SALTS

Estimated Volume: 10,000 gallons per day

The average blended composition is expected to be similar to A-3 except for the following:

Constituent	Average Concentration (%)	Range (%)
NH_3	5.0	2-10
Cr^{+6}	0.1	traces-1
Persulfate	0.5	0-5

TABLE A-7

A-6 ACIDIC NITRATE SOLUTIONS CONTAINING HEAVY METALS

Estimated Volume: 6,000 gallons per day

The average blended composition is expected to be similar to that of A-4 except for the following:

Constituent	Average Concentration (%)	Range (%)
Nitric acid	15	10-20

TABLE A-8

A-7 ACID WASTES WITH HIGH CONCENTRATIONS OF HAZARDOUS METALS (EXCEPT Cr^{+6})

Estimated Volume: 4,000 gallons per day

Estimated Composition is similar to A-4 except for the following:

Constituent	Average Concentration (%)	Range (%)
Arsenic (+3)	5	2-8
Antimony (+3)	5	2-8
Cadmium (+2)	5	2-8

TABLE A-9

B-1 ALKALINE SOLUTIONS CONTAINING CYANIDES

Estimated Volume: 25,000 gallons per day

Estimated composition is as follows:

Constituent	Average Concentration (%)	Range (%)
NaOH	10.0	5-20
Na_2CO_3	3.0	1-5
CN^-	5.0	0.1-10
Ferro/Ferricyanide	1.0	0-10
Chromium (+3)	0.1	0-0.2
Cadmium (+2)	1.0	0-2
Zinc (+2)	2.0	0-3
Copper (+2)	2.0	0-5
Nickel (+2)	0.5	0-2
Arsenic (+3)	0.1	0-0.2
Iron (+2,+3)	2.0	0-5

TABLE A-10

B-2 ALKALINE SOLUTIONS CONTAINING SULFIDE

Estimated Volume: 12,000 gallons per day

Estimated composition is as follows:

Constituent	Average Concentration (%)	Range (%)
NaOH	10.0	5-12
Na_2CO_3	3.0	1-8
Na_2S	5.0	2-7
Soluble organic	0.2	0.1-0.5

TABLE A-11

B-3 CONCENTRATED ALKALIES (NO SULFIDE NOR CYANIDE)

Estimated Volume: 2,000 gallons per day

Estimated composition is as follows:

Constituent	Average Concentration (%)	Range (%)
NaOH	20.0	15-50
Na_2CO_3	5.0	1-10
KOH	5.0	0-20
$Ca(OH)_2$	2.0	0-15
Soluble organics	0.5	0-2

TABLE A-12

B-4 MISCELLANEOUS--ALKALINE SOLUTIONS CONTAINING METALS, ETC.

Estimated Volume: 10,000 gallons per day

Estimated composition as follows:

Constituent	Average Concentration (%)	Range (%)
NaOH	8.0	5-10
Na_2CO_3	2.0	1-3
Arsenic (+3)	2.0	0-3
Selenium (+4)	2.0	0-1
Aluminum (+3)	4.0	0-6
Silicate	2.0	0-5
Soluble organics	3.0	0-5

TABLE A-13

B-5 ALKALINE WASTES WITH HIGH CONCENTRATIONS OF HAZARDOUS HEAVY METALS

Estimated Volume: 2,000 gallons per day

Estimated composition is similar to B-4 except for the following:

Constituent	Average Concentration (%)	Range (%)
Arsenic (+3)	4	3-5
Selenium (+4)	2	1-3

TABLE A-14

C-1 COMBUSTIBLE ORGANIC SLUDGES, SOLIDS, AND LIQUIDS

Estimated Volume: 8,000 gallons per day or
64,000 pounds per day

Typical constituents:

Pesticides and similar materials - organic and organo-metallic

Monomers and polymers

Phenolics

Aliphatic hydrocarbons

Aromatic hydrocarbons

Oils

Still bottoms, tars

Halogenated aromatics

Alcohols, Amines

Organic acids and acid salts

Nitrocompounds

Estimated breakdown: 80% pumpable
20% non-pumpable

TABLE A-15

C-2 CYANIDE CONTAINING SLUDGES, SLURRIES, SOLIDS

Estimated Volume: 1,000 pounds per day average; it is expected that there will be occasional bulk shipments of 1,000-4,000 gallons. Liquid slurries and wastes containing less than 5% cyanide will go to the chemical oxidation system. All wastes with greater than 5% cyanide and all nonpumpable solids and semi solids will go to the incinerator. Probable breakdown is anticipated to be 2/3 to the incinerator and 1/3 to chemical oxidation.

Incinerator Typical Average Composition	
Ferro and Ferricyanides	5%
NaCN/KCN	15%
Na_2CO_3	10%
NaOH	10%
Cyanate	5%
Heavy metal hydroxides	10%
Organic (insoluble)	5%
Calcium hydroxide	5%
Filter aids	

Chemical Oxidation System Typical Average Composition	
NaOH	10%
Na_2CO_3	10%
NaCN/KCN as CN^-	4%
Ferrocyanide/Ferricyanide	4%
Nickel (+2)	3%
Cadmium (+2)	2%
Copper (+2)	5%
Zinc (+2)	4%
Cyanate	3%
Organic (insoluble)	5%

TABLE A-16

C-3 CHROMIUM-CONTAINING SLUDGES, SLURRIES, SOLIDS

Estimated Volume: 1,000 pounds per day

Estimated composition is as follows:

Constituent	Average Concentration (%)	Range (%)
Chromium (+6)	7.0	1-20
Nickel (+2)	0.2	0-1
Zinc (+2)	0.2	0-1
Ferricyanide	0.2	0-2
Cadmium (+2)	0.2	0-1
Copper (+2)	1.0	0-2
Iron (+3)	2.0	0-5
Organics (insoluble)	5.0	0-10
Filter aids	5.0	-
Alkali or acid	10.0	1-15

Do not expect bulk shipments in this category, only drum quantities. Bulk quantities high in chromium will be subjected to recovery processes at waste sources.

TABLE A-17

C-4 INORGANIC SLUDGES, SLURRIES, SOLIDS, AND FILTER CAKES, (NO Cr^{+6} NOR CYANIDE)

Estimated Volume: 32,000 pounds per day

Estimated composition is as follows:

Constituent	Average Concentration (%)	Range (%)
Filter Aids	5	0-10
Carbon	2	0-5
Insoluble organics	4	0-7

Heavy metals contained as hydroxides, oxides, sulfides, fluorides, phosphates, chlorides, sulfates and carbonates. Heavy metals include varying concentrations of arsenic, mercury, cadmium, selenium and antimony at lower levels than found in the C-6 category.

TABLE A-18

C-5 AQUEOUS ORGANIC WASTE STREAMS

Estimated Volume: 10,000 gallons per day

Estimated composition: These streams are made up largely of the water-soluble organics such as low molecular weight alcohols, amines, organic acids and their salts, aldehydes, and ketones. Other constituents will be phenolics, monomers, pesticides, and emulsified oils. Insoluble organics can also be expected. Average water content is estimated to be 90%.

All C-5 type wastes will go to incinerator with supplementary fuel.

TABLE A-19

C-6 INORGANIC SLUDGES, SLURRIES, SOLIDS AND FILTER CAKES WITH HIGH CONCENTRATIONS OF HAZARDOUS HEAVY METALS (NO Cr^{+6} OR CYANIDE)

Estimated Volume: 16,000 pounds per day

Estimated composition is as follows:

Constituent	Average Concentration (%)	Range (%)
$ASO4^{-}$	4.0	0-10
AS_2S_3	6.0	0-20
Sb^{+5}	0.1	0-1
Pb^{+2}	0.1	0-1
Hg^{+2}	0.1	0-0.2
Carbon	2.0	0-5
Filter aids	5.0	0-10
H_3PO_4	5.0	0-20
$KMnO_4$	8.0	0-15
Cu^{++}	3.0	0-5
Fe^{+3}	2.0	0-7
Zn^{+2}	1.0	0-3
NaOH	5.0	0-15
Insoluble organic	4.0	0-7

APPENDIX H

PRELIMINARY PLANT DESIGN AND COST ESTIMATE FOR RECOVERY OF COPPER AND NICKEL FROM METAL FINISHING WASTE SLUDGE

DERIVATION OF COMPOSITION OF A TYPICAL METAL FINISHING WASTE SLUDGE

Typical concentrations of chromium, cyanide, copper, zinc, cadmium, iron, and nickel in combined effluents from several metal-finishing plants are as follows[A-17]:

	PPM
Cr	11.0
CN	28.0
Cu	17.2
Zn	3.7
Cd	1.4
Fe	2.4
Ni	24.0

The hexavalent chromium should be reduced to trivalent chromium before precipitation. The process suggested by Lund[A-18] is as follows:

Wastes	Treatment
Chromium wastes at 2.0 pounds CrO_3 per gallon	0.35 pounds H_2SO_4 1.95 pounds SO_2 10.3 pounds CaO

Iron wastes generally contain 10 percent H_2SO_4 at 0.4 pounds iron per gallon. Therefore when lime is used to precipitate these heavy metals in the form of hydroxide, the quantities of the precipitants would be (on the basis of 1×10^6 pounds of wastewater):

$$Cr(OH)_3 = \frac{(11)(103)}{52} = 21.4 \text{ pounds}$$

$$Cu(OH)_2 = \frac{(17.2)(97.54)}{(63.54)} = 26.4 \text{ pounds}$$

$$Zn(OH)_2 = \frac{(3.7)(99.37)}{(65.37)} = 5.63 \text{ pounds}$$

$$Cd(OH)_2 = \frac{(1.4)(146.40)}{(112.4)} = 1.82 \text{ pounds}$$

$$Fe(OH)_3 = \frac{(2.4)(106.85)}{(55.85)} = 4.37 \text{ pounds}$$

$$Ni(OH)_2 = \frac{(24)(92.71)}{(58.71)} = 37.9 \text{ pounds}$$

$CaSO_4$ produced from the treatment of CrO_3=

$$\frac{(10.3)(136)(100)(11)}{(56)(2)(52)} = 265 \text{ pounds}$$

$CaSO_4$ produced from the treatment of H_2SO_4 in iron waste in $Ca(OH)_2$=

$$\frac{(1.65)(136)(16)(2.4)}{(74)(6.5)} = 17.9 \text{ pounds}$$

The results of the computation can be summarized as shown in Table A-20.

MATERIAL BALANCE

The composition of a typical metal finishing waste sludge is shown in Table A-20. The material balances in the recovery scheme are as follows:

Feed rate = 2×10^4 pounds dry solids per day

Feed rate in slurry (20% solid) = 1×10^5 pounds per day

Leaching:

H_2SO_4 required (50% excess) =

$$\left\{\frac{(2.9)\ (3)\ (98)}{(2)\ (52)} + \frac{(4.5)\ (98)}{(63.54)} + \frac{(1)\ (98)}{(65.37)} + \frac{(0.4)\ (98)}{(112.4)} + \frac{(0.6)\ (3)\ (98)}{(2)\ (55.85)} + \frac{(6.3)\ (98)}{(58.71)}\right\} \cdot$$

$$\left(\frac{2 \times 10^4}{100}\right) (1.5) = 8{,}721 \text{ pounds per day}$$

TABLE A-20

COMPOSITION OF A TYPICAL METAL-FINISHING WASTE SLUDGE (DRY BASIS)

	Hydroxide			Element	
Item	Quantity Pounds	Weight Fraction	Item	Quantity Pounds	Weight Percent
$Cr(OH)_3$	21.4	0.056	Cr	11.0	2.9
$Cu(OH)_2$	26.4	0.069	Cu	17.2	4.5
$Zn(OH)_2$	5.63	0.015	Zn	3.7	1.0
$Cd(OH)_2$	1.82	0.005	Cd	1.4	0.4
$Fe(OH)_3$	4.37	0.011	Fe	2.4	0.6
$Ni(OH)_2$	37.90	0.099	Ni	24.0	6.3
$CaSO_4$	284.90	0.745	Ca	83.1	21.8
Total	382.42	1.000			

Cost of tank (September 1972) = $(4,500)(\frac{334.1}{262.9})$=
$5,719 (using Marshall & Stevens Cost Index)

Rotary Vacuum Filter

A filtration rate of 4 gallons per hour per square foot is assumed for sizing the filter. The fraction of the total filter area submerged in the slurry is assumed to be 0.3.

Filter area = $\frac{(459)}{(4)\quad(0.3)}$ = 383 square feet

Cost of rotary vacuum filter with 400 square feet total filter area (complete with a vacuum pump and auxiliaries) = $60,000

Number of filters required = 3

Neutralization Tank

The residence time of the solution is assumed to be 0.5 hours for sizing the neutralization tank.

Volume of filtrate from Filtration I = 9,589 +

$213 + 3{,}000 - \frac{(22{,}236)}{(62.4)(0.1337)}$ = 10,137 gallons per day

Flow rate to Neutralization I = $\frac{10{,}137}{24}$ = 422 gallons per hour

Volume of Neutralization Tank I = (0.5)(422)(1.2) =
253 gallons (assuming 20% excess volume)

Cost of tank (January 1967) = $3,000

Cost of tank (September 1972) = $(3,000)(\frac{334.2}{262.9})$ = $3,815

Precipitation Tank

The residence time of the solution is assumed as 0.5 hour for sizing the precipitation tank.

Flow rate = 425 gallons per hour

Precipitation tank volume = (0.5)(425)(1.2) =
255 gallons (assuming 20% excess volume)

Cost of Tank (September 1972) = $3,815[A-19]

Pumps and Motors

Flow rate = 8 to 10 gallons per minute

Cost of pump (capacity, 10 gallons per minute; head, 25 feet) (January 1967) = $330[A-20]

Cost of pump (September 1972 = (330) $(\frac{334.1}{262.9})$ = $420

Cost of motor (power, 1/4 HP) (January 1967) = $90[A-20]

Cost of motor (September 1972) = (90) $(\frac{334.1}{262.9})$ = $105

Number of pumps required = 9

Number of motors required = 9

Electrolysis

Cost of electrolysis system with capacity of 46 pound per day = $5,830[A-21]

Cost of electrolysis system with capacity of 2,160 pounds per day = (5,830) $(\frac{2,160}{46})$ 0.6 = $58,300 (using 0.6 power scale-up factor)

Raw Material

H_2SO_4 required (98% H_2SO_4) = $\frac{8,721}{0.98}$ = 8,899 pounds per day

Cost of H_2SO_4 (at $31.68 per ton) = (8,899)[A-22] $(\frac{31.68}{2,000})$ = $141 per day

CaO required = 5,554 pounds per day

Cost of CaO (at $19.00 per ton) = (5,554) $(\frac{19}{2,000})$ = $53 per day

Utilities

Wash water required = 3,900 gallons per day

Cost of wash water (at $0.5 per 1,000 gallons) = (3,900) $(\frac{0.5}{1,000})$ = $2 per day

Power required for electrolysis (at 1.5 kilowatt hours per pound of Cu or Ni) = (1.5)(900 + 1,260) = 3,240 kilowatt hours per day[A-23]

Power required for pumping = $(\frac{1}{4})$ (0.746)(24)(9) = 40 kilowatt hours per day

Number of agitators needed = 4

Filtration I:

Total slurry to be filtered = $1 \times 10^5 + 8{,}721 =$ 108,721 pounds per day

Total solids in slurry = $\frac{(21.8)\ (136)\ (2 \times 10^4)}{(40)\ (100)} =$ 14,824 pounds per day

Wash in filter cake (40% solid) = $\frac{(14{,}824)\ (60)}{(40)} =$ 22,236 pounds per day

Wash water used = (15) = 3,000 gallons per day = (3,000) (0.1337) (62.4) = 25,029 pounds per day

Amount of filtrate = 108,721 + 25,029 - 14,824 22,236 = 99,690 pounds per day

Neutralization I:

Moles of H_2SO_4 in filtrate = $\frac{(8{,}721)}{(3)\ (98)} = 29.66$ pounds-moles

CaO required for neutralizing H_2SO_4 = (29.66) (56) = 1.661 pounds per day

CaO required for precipitating $Fe_2(SO_4)_3$ = $\frac{(0.6)\ (2 \times 10^4)\ (3)\ (56)}{(100)\ (2)\ (55.85)} = 180$ pounds per day

Total CaO required = 1,841 pounds per day

Filtration II:

Total slurry to be filtered = 96,690 + 1,841 = 98,531 pounds per day

Total solid in slurry = $\left[\frac{(0.6)\ (160)}{(2)\ (55.85)} + \frac{(0.6)\ (3)\ (136)}{(2)\ (55.85)}\right] \times \left(\frac{2 \times 10^4}{100}\right) + (29.66)\ (136) =$ 4,644 pounds per day

Water in filter cake (40% solid) = $\frac{(4{,}644)\ (60)}{(40)} =$ 6,966 pounds per day

Wash water used = 900 gallons per day
= (900) (0.1337) (62.4)
= 7,509 pounds per day

Amount of filtrate = 9.853 + 7,509 - 4,644 - 6,966 = 94,430 pounds per day

Electrolysis:

Cu produced = $(4.5)\ (\frac{2 \times 10^4}{100}) = 900$ pounds per day

Ni produced = $(6.3)\ (\frac{2 \times 10^4}{100}) = 1{,}260$ pounds per day

H_2SO_4 produced = $[\frac{(4.5)\ (2)\ (98)}{(2)\ (63.55)}] + [\frac{(6.3)\ (2)\ (98)}{(2)\ (58.71)}]$
$(\frac{2 \times 10^4}{100}) = 3{,}488$ pounds per day

Precipitation:

CaO required for neutralizing $H_2SO_4 = (35{,}59)\ (56) =$
1,993 pounds per day

CaO required for precipitating $Cr_2(SO_4)_3$ (50% excess) =
$\frac{(2.9)\ (2 \times 10^4)\ (3)\ (56)\ (1.5)}{(100)\ (2)\ (52)} = 1{,}405$ pounds per day

CaO required for precipitating $CdSO_4$ (50% excess) =
$\frac{(0.4)\ (2 \times 10^4)\ (56)\ (1.5)}{(100)\ (112.41)} = 60$ pounds per day

CaO required for precipitating $ZnSO_4$ (50% excess) =
$\frac{(1)\ (2 \times 10^4)\ (56)\ (1.5)}{(100)\ (65.38)} = 257$ pounds per day

Total CaO required = 3,715 pounds per day

Total slurry to be filtered = 95,985 pounds per day

Cr_2O_3 produced = $\frac{(2.9)\ (2 \times 10^4)\ (152)}{(100)\ (2)\ (52)} = 848$ pounds per day

$Cd(OH)_2$ produced = $\frac{(0.4)\ (2 \times 10^4)\ (146.41)}{(100)\ (112.41)} = 104$ pounds per day

$Zn(OH)_2$ produced = $\frac{(1)\ (2 \times 10^4)\ (99.38)}{(100)\ (65.38)} = 304$ pounds per day

$CaSO_4$ produced = $(35.59)\ (136) + [\frac{(0.4)\ (136)}{(112.41)} +$
$\frac{(1)\ (136)}{(65.38)}]\ (\frac{2 \times 10^4}{100}) = 4{,}840 + 97 + 416 =$
5,353 pounds per day

Total solid in slurry = 6,609 pounds per day

Water in filter cake (40% solid) = $\frac{(6{,}609)\ (60)}{(40)} =$
9,914 pounds per day

Amount of filtrate = 95,985 - 6,609 - 9,914 =
79,462 pounds per day

EQUIPMENT SIZING AND COST ESTIMATION

Equipment design for the conceptual process evaluation involved the selection and sizing of the equipment needed in the process. Capital and operating costs were estimated as follows.

Leaching Tank

The residence time of the slurry in the tank is assumed as 1 hour for sizing the leaching tank.

Volume of water in feed = 80,000 pounds per day

$$\frac{(80{,}000)}{(0.1337)(62.4)} = 9{,}589 \text{ gallons per day}$$

$$\text{Volume of solids in sludge} = \frac{(2 \times 10^4)}{(0.1337)(100)(62.4)}$$

$$\left[\frac{5.6}{5.21} + \frac{6.9}{3.37} + \frac{74.12}{2.61} + \frac{0.5}{4.79} + \frac{4.37}{2.17} + \frac{3.79}{4.15} + \frac{5.63}{3.05}\right] = 1{,}070 \text{ gallons per day}$$

$$\text{Volumetric feed rate} = \frac{9{,}589 + 1{,}070}{24} = 444 \text{ gallons per hour}$$

$$\text{Water produced in leaching} = \left[\frac{(2.9)(3)(18)}{(2)\ (52)} + \frac{(4.5)(2)(18)}{(63.54} + \frac{(1)(2)(18)}{(65.37} + \frac{(0.4)(2)(18)}{(112.40)} + \frac{(0.6)(3)(18)}{(2)(55.85)} + \frac{(6.3)(2)(18)}{(58.71}\right] \left(\frac{2 \times 10^4}{100}\right) =$$

$$1{,}778 \text{ lb/day} = \frac{(1{,}778)}{(0.1337)(62.4)} = 213 \text{ gallons per day}$$

$$\text{Volumetric flow rate to Filtration I} = \left[9{,}589 + 213 + \frac{(8{,}721)}{(1.84)(62.4)(0.1337)} + \frac{(74.12)(2 \times 10^4)}{(100)(2.61)(62.4)(0.1337)}\right]$$

$$\left(\frac{1}{24}\right) = \frac{(9{,}589 + 213 + 568 + 681)}{(24)} = \frac{11{,}051}{24} = 460 \text{ gal/hr}$$

Leaching tank volume = (1)(460)(1.2) = 552 gallons
(assuming 20% excess volume)

Cost of tank (January 1967) = $4,500

Power required for agitation at 10 HP = (10)
(0.746)(24) (4) = 716 kilowatt hours per day

Total power required = 3,996 kilowatt hours per day

Cost of power (at $0.1 per kilowatt hour) = (3,996)
(0.01) = $40 per day

A summary of the equipment items and the estimated purchased equipment cost is presented in Table A-21. The estimated fixed-capital cost is given in Table A-22. The estimates of the total manufacturing costs, including credits for recovered metals for sale, are presented in Table A-23.

TABLE A-21

EQUIPMENT SPECIFICATIONS AND ESTIMATED COST OF PURCHASED EQUIPMENT FOR METAL RECOVERY SCHEME

Process Step	Equipment	Size	No. Required	Construction Materials	Purchased Cost, Dollars (1972)
Leaching	Mixing tank with agitator	550 gal	1	304 Stainless Steel	5,719
Filtration	Rotary vacuum filter with pumps and motors	400 ft^2	3	316 Stainless Steel	180,000
Neutralization	Mixing tank with agitator	250 gal	1	304 Stainless Steel	3,815
Electrolysis	Electrolytic copper and nickel recovery system	2,160 lb/day			58,300
Precipitation	Mixing tank with agitator	250 gal	1	304 Stainless Steel	3,815
Pumping	Pumps with motors	Capacity, 10 gpm; head, 25 ft; power, 1/4 hp	9	304 Stainless Steel	4,725
				TOTAL	256,374

TABLE A-22

FIXED-CAPITAL INVESTMENT ESTIMATE

Items	Cost, Dollars (1972)[A-20]
Purchased equipment, E	256,374
Purchased equipment installation, 39% E	99,986
Instrumentation (installed), 28% E	71,785
Piping (installed), 31% E	79,746
Electrical (installed), 10% E	25,637
Buildings, 22% E	56,402
Yard Improvements, 10% E	25,637
Service facilities (installed), 30% E	76,912
Land, 6% E	15,382
Total direct plant cost, D	707,861
Engineering and supervison, 32% E	82,040
Construction expenses, 34% E	87,167
Total direct and indirect cost (D+I)	877,068
Contractor's fee, 5% (D+I)	43,853
Contingency, 10% (D+I)	87,707
Fixed capital investment	1,008,628

TABLE A-23

DAILY OPERATING COST ESTIMATE*

Items	Daily Operating Cost, Dollars Per Day
Raw Material	
Sulfuric acid (98 percent at $31.68[A-22] per ton)	141
Lime (at $19.00 per ton)[A-22]	53
Utilities	
Electricity (at 12 mills per kilowatt hour)[A-23]	48
Water (at $0.5 per 1000 gallons)	2
Labor (2 men per shift, 2 shifts per day at $7.62 per hour)	366
Supervision (20 percent of labor)	73
Maintenance (5 percent of FCI per year)	233
Overhead (2.3 percent of FCC)	89
Amortization (7 percent for 10 years)	552
Insurance and taxes (2.2 percent of FCI per year)	85
Total daily operating cost	1,642
Credit	
Copper (at $0.5 per pound)[A-22]	450
Nickel (at $1.40 per pound)[A-23]	1,764
Total Credit	2,214
Net Daily Profit	572

*Basis: 300 days per year, 24 hour per day operation

APPENDIX I

PRELIMINARY PLANT DESIGN AND COST ESTIMATE FOR WASTE SOLVENT RECOVERY

PRELIMINARY PROCESS DESIGN

Storage Tanks

Storage tanks in the solvent recovery facility will be used in three different situations: storage of incoming wastes, storage of condensed vapors from the Luwa evaporator, and storage of the final products. Listed in Table A-24 is the capacity of each storage tank. These storage facilities should supply sufficient flexibility for any unusual conditions.

Luwa Evaporator

The Luwa evaporator is an agitated wiped-film unit used to separate the solvent from solids, sludge, or nonvolatile materials (liquids or polymers). The heat load is based on requirements for raising the solvents to the boiling point and vaporizing them. This load based on 14,000 gallons per day, 300 days per year and 24 hour per day operation amounts to 1.6×10^6 BTU per hour, assuming around 80 percent efficiency of heat utilization. Based on an overall heat transfer rate of 10,000 BTU per hour per square foot, a Luwa evaporator with 106 square feet is required.

Pumps

The solvent will be pumped from the waste storage tank to the Luwa evaporator at the rate of 560 gallons per hour or 10 gallons per minute by a centrifugal pump of 10 gallons per minute and 60 feet head. Pumps of the same size will also be used to deliver feed to the distillation column and to move the products from the distillation column to the storage tanks.

Partial Condensers C1, C2, and C3

The vapors from the Luwa evaporator will be condensed in three different cuts and stored in tanks for further separations in the distillation column. The temperature of the coolant to each condenser will be controlled to condense perchlorethylene and o-dichlorobenzene in the first condenser; methyl chloroform, carbon tetrachloride, ethylene dichloride, and trichlorethylene in the second condenser; and methyl chloride and chloroform in the third condenser.

TABLE A-24

CAPACITY OF STORAGE TANKS

Units	Capacity, gal	Solvent Rate gal/day	Holding Capacity days
Raw waste storage (WI)	100,000	14,000	6
First cut from Luwa (CI)	30,000	1,900	14
Second cut from Luwa (C2)	100,000	9,100	10
Third cut from Luwa (C3)	30,000	2,330	11
Distillate stock from first cut (DI)	3,000	465	5
Reboiler stock from first cut (RI)	10,000	1,500	5
Distillate stock from second cut (D2)	40,000	7,000	5
Reboiler stock from second cut (R2)	10,000	1,900	5
Distillate stock from third cut (D3)	3,000	520	5
Reboilder stock from third cut (R3)	10,000	1,810	5

The cooling loads in the three condensers and their sizes (based on a heat-transfer rate of 1,000 BTU per hour per square foot) are:

Unit	Cooling Load, Btu/hr	Heat-Transfer Surface Area, sq ft
C1	0.131×10^6	131
C2	0.833×10^6	833
C3	0.153×10^6	153

Distillation Column

The distillation column was sized on the basis of the unit used by Chem-Trol Pollution Services, Inc. (Model City, New York). The column will be a bubble-cap unit with 40 plates, each 3 feet in diameter. There will be 18 inches between plates.

Reboiler

The reflux ratio is taken as 3 to 1 for sizing the reboiler. The heat load on the reboiler is estimated as 1.47×10^6 BTU per hour. Based on a heat transfer rate of 82,000 BTU per hour per square foot, the total heat transfer surface area is estimated as 18.3 square feet. Allowing for heat losses, a reboiler with a 40 square foot heat transfer area will be required.

Distillation Column Condenser

At a reflux ratio of 3 to 1 the cooling load of the condenser is estimated to be 1.28×10^6 BTU per hour. At an assumed overall heat transfer rate of 1000 BTU per hour per square foot, the heat transfer surface area required for the average load is estimated as 1,280 square feet.

Cooling Tower

The total cooling load on the process is estimated as 2.4×10^6 BTU per hour. Based on a temperature rise of 10 °F for cooling water through each of the condensers, the total cooling water requirement is estimated as 240,000 pounds per hour or 480 gallons per minute for sizing a cooling tower.

Cost Estimation

Preliminary cost estimation was made on the waste solvent recovery process by the same process cost estimating method used in Appendix H. Specifications of equipment items and their estimated purchase costs are given in Table A-25 . Estimated fixed capital investment cost is given in Table A-26 . The total

TABLE A-25

EQUIPMENT SPECIFICATIONS AND ESTIMATED COSTS

Process Step	Equipment	Size	Number Required	Material of Construction	Purchased Cost, dollars (1972)
Raw waste storage (W1)	Holding Tank	100,000 gal	1	Carbon steel	$ 14,700
Condensate storage (C1), (C3)	Holding Tank	30,000 gal	2	Carbon steel	19,600
Condensate storage (C2)	Holding Tank	100,000 gal	1	Carbon steel	14,700
Distillate storage (D1), (D3)	Holding Tank	3,000 gal	2	Carbon steel	2,940
Distillate storage (D2)	Holding Tank	40,000 gal	1	Carbon steel	8,000
Reboiler stock storage (R1), (R2), (R3)	Holding Tank	10,000 gal	3	Carbon steel	10,500
Solvent separation	Luwa Evaporator	106 sq ft	1	Stainless steel	45,000
Flow of liquid	Centrifugal Pump	3/4 HP-10 gpm, 60-ft head	3	Carbon steel	1,800
Partial condensation	Condensers	C1-131 sq ft	1	Carbon steel	1,400
		C2-833 sq ft	1	Carbon steel	4,270
		C3-153 sq ft	1	Carbon steel	1,500
Solvent separation	Distillation Column	3-ft dia, 40 plates	1	Carbon steel	30,800
Distillation column heater	Reboiler	40 sq ft	1	Carbon steel	3,010
Distillation column condenser	Condenser	1,280 sq ft	1	Carbon steel	1,760
Cooling water	Cooling Tower	480 gal/min	1	Wood	5,000
			Total Purchased Equipment Cost		$164,980

TABLE A-26

ESTIMATE OF FIXED CAPITAL COST

Component	Cost, dollars
Purchased equipment (delivered), E	$164,980
Purchased equipment installation, 39% E	64,110
Instrumentation (installed), 28% E	46,194
Piping (installed), 31% E	51,143
Electrical (installed) 10% E	16,498
Yard improvements, 10% E	16,498
Service facilities (installed), 55% E	90,739
Land, 6% E	9,898
Total direct plant cost, D	$460,060
Engineering and supervision, 32% E	52,793
Construction expenses, 34% E	56,093
Total direct and indirect cost, (D + I)	$568,946
Contractor's fee, 5% (D + I)	33,295
Contingency, 10% (D + I)	66,591
Fixed capital cost	$668,836

processing cost, including the credit for the recovered solvents, is shown in Table A-27. The recovery process shows a net income of about $7,000 per day. The process appears to be a promising means of deriving a substantial income.

TABLE A-27

ESTIMATE OF OPERATING COST

Basis: 200 days per year, 24 hours per day operation

Fixed Capital Cost, (FCC)	$668,836
Component	Daily Cost Dollars per Day
Utilities	
Electricity at 12 mills per kilowatt hour	5
Steam at $0.85 per 10^6 BTU	68
Labor	
$7.62 per hour, 2 men per shift	366
Supervision	
20 percent of labor	73
Maintenance	
6 percent of FCC	154
Plant Overhead	
2.3 percent	59
Depreciation	
10 percent per year of FCC	366
Taxes and Insurance	
5 percent per year of FCC	57
Total Daily Operating Cost	$1,148
Credit for Solvents Recovered	
161,000 pounds per day at $0.05 per pound	$8,050 per day
Net Income	$6,902 per day

APPENDIX J

PRELIMINARY CAPITAL AND OPERATING COSTS FOR MODEL PROCESSING AND DISPOSAL FACILITIES

Capital and operating costs were estimated for the various processing modules of a medium size facility with a design capacity of 122,000 gallons per day of aqueous waste and 74 tons per day of combustible wastes. Capital and operating costs were then estimated, using scale-up factors, for a small facility (design capacity of 25,000 gallons per day aqueous waste and 15 tons per day of combustible waste) and a large facility (design capacity of 1 million gallons per day and 607 tons per day of combustible waste). A scale-up factor of 0.6 was used consistently except for the large evaporation module. The 0.6 scale-up factor is commonly used with good results in preliminary design work to estimate the cost of larger or smaller equipment similar to that for which cost data are available. If the cost of a given system at one capacity is known, the cost of a similar system with x times the capacity of the first is approximately $(x)^{0.6}$ times the cost of the initial system.[A-24] A scale-up factor of 0.9 was used in estimating the cost of the large evaporation module since multiple packaged evaporator systems were required.

The capital and operating costs for the processing modules or module units are given in Tables A-28 through A-66. The chemical treatment module is broken down into four units:

- oxidation,
- reduction,
- neutralization-precipitation (primary), and
- sulfide precipitation (secondary).

The liquid-solids separation is also broken down into four units:

- primary clarification and filtration,
- secondary clarification and filtration,
- incinerator scrubber water clarification and ash filtration, and
- brine filtration.

Subdivision of the chemical treatment and liquid-solids separation module allows detailed examination of the costs associated with the various steps in these modules.

Capital costs of the processing modules include the cost of land, buildings, laboratory, auxiliary equipment, engineering design, fees, and contingencies. The cost of the administration/laboratory building, the process building, and land for the medium size facility are given below:

	Cost
Administration/laboratory building	$850,000
Process building	500,000
Land (10 acres)	100,000

The cost of the above items was subdivided amoung the various processing modules according to anticipated usage or space requirements.

The capital and operating costs of a secured landfill to process and bury 157 tons per day of sludge containing hazardous heavy metals are given in Table A-67. A land area of 200 acres are used for burial activities. The extra land is included as a buffer zone to provide sufficient time for corrective measures in the event ground water contamination is detected in the vicinity of the burial trenches. It is planned that the burial site will be used for a period of 30 years. Title of the land will be transferred to the State Government as in the case of the Morehead radioactive waste burial site in Kentucky. The land will be leased by the disposal company for a nominal fee and a charge of 4 percent levied on the burial charge to cover administrative costs for perpetual surveilance. Significant cost items for the secured landfill include an asphalting plant ($703,000), a railroad spur ($491,000), land ($400,000), and trenching and backfilling equipment ($191,000). Miscellaneous items such as fencing, roadways, and storage facilities account for the remaining cost.

Operating costs based on fixed capital costs (FCC) are as follows:

	Percent of FCC per year
Capital amortization (7 percent for 10 years)	14.24
Maintenance	6.0
Overhead	2.3
Insurance and taxes	2.2

The hourly rate for operating labor is $7.62 which includes fringe benefits, assessments, and personnel supplies.

Essential material costs used in estimating operating costs for the treatment and disposal facilities are given below:

Material	Cost per ton, $
Lime, unslaked	18.00
Sulfur dioxide	220.00
Caustic soda, 50 percent	76.00
Chlorine	75.00
Sodium sulfide, flake	145.00
Hydrochloric acid, 35 percent	42.00
Activated carbon	700.00
Asphalt	30.00

Anticipated personnel requirements for a medium size treatment facility are given in Table A-68.

TABLE A-28

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
WASTE RECEIVING, SEGREGATION, AND STORAGE MODULE

	Dollars
FIXED CAPITAL COST	$3,270,000
OPERATING COST, DAILY	
Labor	2,500
Supervision	462
Maintenance	755
Utilities	138
Laboratory Services	213
Overhead	289
Taxes and Insurance	276
	4,633
Capital Amortization	1,791
Total Operating Cost	$ 6,424
AVERAGE COST PER TON (623 Tons per Day)	$ 10.30
AVERAGE COST PER 1000 GALLONS OF AQUEOUS-INORGANIC WASTE (Basis: 9 pounds per gallon)	$ 46.40

TABLE A-29

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
AMMONIA STRIPPING MODULE

	Dollars
FIXED CAPITAL COST	$773,800
OPERATING COST, DAILY	
Labor	91
Supervision	23
Maintenance	178
Utilities	50
Laboratory Services	53
Overhead	68
Taxes and Insurance	65
	528
Capital Amortization	424
Total Operating Cost	$ 952
COST PER 1000 GALLONS AMMONIA WASTE (10,000 gpd)	$ 95.20
AVERAGE COST PER GALLON (122,000 gpd)	$ 7.80

TABLE A-30

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY

CHEMICAL TREATMENT MODULE

Chemical Oxidation of Cyanide Wastes

		Dollars
FIXED CAPITAL COST		$399,000
OPERATING COST, DAILY		
Chlorine		877
Labor		251
Supervision		34
Maintenance		92
Utilities		50
Laboratory Services		40
Overhead		109
Taxes and Insurance		34
		1,487
Capital Amortization		219
Total Daily Operating Cost	$	1,706
COST PER 1000 GALLONS CYANIDE WASTE (25,000 gpd)	$	68.20
AVERAGE COST PER 1000 GALLONS (122,000 gpd)	$	14.00

TABLE A-31

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY

CHEMICAL TREATMENT MODULE

Chemical Reduction of Chromium-6 Wastes

	Dollars
FIXED CAPITAL COST	$337,000
OPERATING COST, DAILY	
Sulfur Dioxide	561
Labor	129
Supervision	34
Maintenance	78
Utilities	50
Laboratory Services	40
Overhead	30
Taxes and Insurance	29
	1,030
Capital Amortization	185
Total Operating Cost	$ 1,215
COST PER THOUSAND GALLONS OF CR^{+6} WASTE (42,000 gpd)	$ 28.90
AVERAGE COST PER THOUSAND GALLONS (122,000 gpd)	$ 10,00

TABLE A-32

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY

CHEMICAL TREATMENT MODULE

Neutralization-Precipitation

	Dollars
FIXED CAPITAL COST	$3,592,000
OPERATING COST, DAILY	
Lime	1,400
Flocculant	500
Hydrochloric Acid	54
Labor	391
Supervision	104
Maintenance	829
Utilities	50
Laboratory Services	40
Overhead	420
Taxes and Insurance	304
	4,092
Capital Amortization	1,967
Total Daily Operating Cost	$ 6,059
COST PER THOUSAND GALLONS (122,000 gpd)	$ 49.70

TABLE A-33

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
CHEMICAL TREATMENT MODULE

Metallic Sulfide Precipitation

	Dollars
FIXED CAPITAL COST	$406,000
OPERATING COST, DAILY	
Sodium Sulfide	1,450
Flocculant	250
Labor	117
Supervision	34
Maintenance	94
Utilities	50
Laboratory Services	40
Overhead	36
Taxes and Insurance	34
	2,105
Capital Amortization	222
Total Daily Operating Cost	$ 2,327
COST PER 1000 GALLONS (212,000 gpd)	$ 11.00

TABLE A-34

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
LIQUID-SOLIDS SEPARATION MODULE

Primary Clarification & Filtration

	Dollars
FIXED CAPITAL COST	$3,216,700
OPERATING COSTS, DAILY	
Labor	73
Supervision	23
Maintenance	742
Utilities	50
Laboratory Services	36
Overhead	284
Taxes and Insurance	272
	1,480
Capital Amortization	1,762
Total Capital Cost	$ 3,242
COST PER 1,000 GALLONS (122,000 gpd)	$ 26.60

TABLE A-35

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
LIQUID-SOLIDS SEPARATION MODULE

Secondary Clarification & Filtration

	Dollars
FIXED CAPITAL COST	$2,284,200
OPERATING COSTS, DAILY	
Labor	79
Supervision	23
Maintenance	527
Utilities	50
Laboratory Services	36
Overhead	202
Taxes and Insurance	193
	1,110
Capital Amortization	1,251
Total Daily Operating Cost	$ 2,361
COST PER 1,000 GALLONS (212,000 gpd)	$ 11.10

TABLE A-36

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
LIQUID-SOLIDS SEPARATION MODULE

Incinerator Scrubber Water Clarifier

	Dollars
FIXED CAPITAL COST	$3,231,800
OPERATING COSTS, DAILY	
Flocculant	250
Labor	79
Supervision	23
Maintenance	746
Utilities	50
Laboratory Service	36
Overhead	286
Taxes and Insurance	273
	1,743
Capital Amortization	1,770
Total Daily Operating Cost	$ 3,513
COST PER 1,000 GALLONS (90,000 gpd)	$ 39.00

TABLE A-37

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
LIQUID-SOLIDS SEPARATION MODULE

Brine Filtration

	Dollars
FIXED CAPITAL COST	$231,000
OPERATING COSTS, DAILY	
Chlorine	46
Labor	31
Supervision	10
Maintenance	53
Utilities	50
Laboratory Service	45
Overhead	20
Taxes and Insurance	19
	274
Capital Amortization	126
Total Daily Operating Cost	$ 400
COST PER 1,000 GALLONS (212,000 gpd)	$ 1.89

TABLE A-38

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
CARBON SORPTION MODULE

	Dollars
FIXED CAPITAL COST	$941,000
OPERATING COSTS, DAILY	
Labor	213
Supervision	23
Make-up Carbon	286
Maintenance	217
Utilities	54
Laboratory Services	107
Overhead	83
Taxes and Insurance	80
	1,063
Capital Amortization	515
Total Daily Operating Cost	$ 1,578
COST PER 1000 GALLONS (212,000 gpd)	$ 7.44

TABLE A-39

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
SUBMERGED COMBUSTION EVAPORATION MODULE

	Dollars
FIXED CAPITAL COST	$514,000
OPERATING COSTS, DAILY	
Labor	91
Supervision	23
Maintenance	119
Utilities	103
Fuel	1,425
Laboratory Services	40
Overhead	46
Taxes and Insurance	44
	1,891
Capital Amortization	282
Total Operating Cost, Daily	$ 2,173
COST PER 1,000 GALLONS (212,000 gpd)	$ 10.20

TABLE A-40

PRELIMINARY COST ESTIMATE FOR MEDIUM SIZE FACILITY
INCINERATOR SYSTEM

	Dollars
FIXED CAPITAL COST	$4,873,000
OPERATING COSTS, DAILY	
Labor	706
Supervision	246
Maintenance	1,124
Power	277
Fuel	923
Laboratory Services	213
Overhead	431
Taxes and Insurance	412
	4,332
Capital Amortization	2,669
Total Daily Operating Cost	$ 7,001
COST PER TON (74 Tons)	$ 94.60

TABLE A-41

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY WASTE RECEIVING, SEGREGATION, AND STORAGE MODULE

		Dollars
FIXED CAPITAL COST		$1,262,000
OPERATING COSTS, DAILY		
Labor		513
Supervision		95
Maintenance		291
Utilities		28
Laboratory Services		44
Overhead		112
Taxes and Insurance		107
		1,190
Capital Amortization		691
Total Operating Cost, Daily	$	1,881
AVERAGE COST PER TON (128 tons per day)	$	14.70
AVERAGE COST PER 1,000 GALLONS OF AQUEOUS-INORGANIC WASTE (Basis: 9 pounds per gallon)	$	66.20

TABLE A-42

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
AMMONIA STRIPPING MODULE

	Dollars
FIXED CAPITAL COST	$298,700
OPERATING COSTS, DAILY	
Labor	91
Supervision	23
Maintenance	69
Utilities	10
Laboratory Services	53
Overhead	26
Taxes and Insurance	25
	297
Capital Amortization	164
Total Daily Operating Cost	$ 461
AVERAGE COST PER 1,000 GALLONS (2,050 gpd)	$ 225.00
AVERAGE COST PER 1,000 GALLONS (25,000 gpd)	$ 18.40

TABLE A-43

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
CHEMICAL TREATMENT MODULE

Chemical Oxidation of Cyanide Waste

	Dollars
FIXED CAPITAL COST	$154,000
OPERATING COST, DAILY	
Chlorine	180
Labor	251
Supervision	34
Maintenance	36
Utilities	10
Laboratory Services	40
Overhead	14
Taxes and Insurance	13
	558
Capital Amortization	84
Total Daily Operating Cost	$ 642
AVERAGE COST PER 1,000 GALLONS (5,125 gpd)	$ 125.00
AVERAGE COST PER 1,000 GALLONS (25,000 gpd)	$ 25.70

TABLE A-44

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
CHEMICAL TREATMENT MODULE

Chemical Reduction of Chromium-6 Wastes

	Dollars
FIXED CAPITAL COST	$130,100
OPERATING COST, DAILY	
Sulfur Dioxide	115
Labor	129
Supervision	34
Maintenance	30
Utilities	10
Laboratory Services	40
Overhead	12
Taxes and Insurance	11
	381
Capital Amortization	71
Total Daily Operating Cost	$ 452
AVERAGE COST PER 1000 GALLONS (8,610 gpd)	$ 52.50
AVERAGE COST PER 1000 GALLONS (25,000 gpd)	$ 18.10

TABLE A-45

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
CHEMICAL TREATMENT MODULE

Neutralization-Precipitation

	Dollars
FIXED CAPITAL COST	$1,386,500
OPERATING COSTS, DAILY	
Lime	287
Flocculant	103
Hydrochloric Acid	11
Labor	391
Supervision	104
Maintenance	320
Utilities	10
Laboratory Services	40
Overhead	123
Taxes and Insurance	117
	1,506
Capital Amortization	759
Total Daily Operating Cost	$ 2,265
AVERAGE COST PER 1000 GALLONS (25,000 gpd)	$ 90.60

TABLE A-46

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
CHEMICAL TREATMENT MODULE

Metallic Sulfide Precipitation

	Dollars
FIXED CAPITAL COST	$156,700
OPERATING COSTS, DAILY	
Sodium Sulfide	297
Flocculant	51
Labor	117
Supervision	34
Maintenance	36
Utilities	10
Laboratory Service	40
Overhead	14
Taxes and Insurance	13
	612
Capital Amortization	86
Total Daily Operating Cost	$ 698
COST PER 1,000 GALLONS (43,400 gpd)	$ 16.10

TABLE A-47

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
SOLIDS-LIQUID SEPARATION MODULE

Primary Clarification and Filtration

	Dollars
FIXED CAPITAL COST	$1,241,600
OPERATING COSTS, DAILY	
Labor	73
Supervision	23
Maintenance	287
Utilities	10
Laboratory Services	36
Overhead	110
Taxes and Insurance	105
	644
Capital Amortization	680
Total Daily Operating Cost	$ 1,324
COST PER 1,000 GALLONS (25,000 gpd)	$ 53.00

TABLE A-48

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
LIQUID-SOLID SEPARATION MODULE

Secondary Clarification and Filtration

	Dollars
FIXED CAPITAL COST	$881,700
OPERATING COSTS, DAILY	
Labor	79
Supervision	23
Maintenance	203
Utilities	10
Laboratory Services	36
Overhead	78
Taxes and Insurance	75
	504
Capital Amortization	483
Total Daily Operating Cost	$ 987
COST PER 1,000 GALLONS (43,400 gpd)	$ 22.70

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TABLE A-49

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
LIQUID-SOLIDS SEPARATION MODULE

Incinerator Scrubber Water Clarifier

	Dollars
FIXED CAPITAL COST	$1,247,500
OPERATING COSTS, DAILY	
Flocculant	51
Labor	79
Supervision	23
Maintenance	288
Utilities	10
Laboratory Services	36
Overhead	110
Taxes and Insurance	106
	703
Capital Amortization	683
Total Daily Operating Cost	$ 1,386
COST PER 1,000 GALLONS (18,450 gpd)	$ 75.10

TABLE A-50

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
LIQUID-SOLIDS SEPARATION MODULE

Brine Filtration

	Dollars
FIXED CAPITAL COST	$89,200
OPERATING COSTS, DAILY	
Chlorine	9
Labor	31
Supervision	10
Maintenance	21
Utilities	10
Laboratory Services	45
Overhead	8
Taxes and Insurance	8
	142
Capital Amortization	49
Total Daily Operating Cost	$ 191
COST PER 1,000 GALLONS (43,500 gpd)	$ 4.39

TABLE A-51

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
CARBON SORPTION MODULE

	Dollars
FIXED CAPITAL COST	$363,000
OPERATING COSTS, DAILY	
Labor	213
Supervision	23
Make-up Carbon	59
Utilities	11
Maintenance	83
Laboratory Services	107
Overhead	32
Taxes and Insurance	31
	559
Capital Amortization	199
Total Daily Operating Cost	$ 758
COST PER 1,000 GALLONS (43,400 gpd)	$ 17.50

TABLE A-52

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
SUBMERGED COMBUSTION EVAPORATION MODULE

	Dollars
FIXED CAPITAL COST	$198,000
OPERATING COSTS, DAILY	
Labor	91
Supervision	23
Maintenance	46
Utilities	21
Fuel	292
Laboratory Services	40
Overhead	18
Taxes and Insurance	17
	527
Capital Amortization	108
Total Daily Operating Cost	$ 635
COST PER 1,000 GALLONS (43,400 gpd)	$ 14.63

TABLE A-53

PRELIMINARY COST ESTIMATE FOR SMALL SIZE FACILITY
INCINERATOR SYSTEM

	Dollars
FIXED CAPITAL COST	$1,881,000
OPERATING COSTS, DAILY	
Labor	706
Supervision	246
Maintenance	434
Power	57
Fuel	189
Laboratory Services	213
Overhead	166
Taxes and Insurance	159
	2,170
Capital Amortization	1,030
Total Daily Operating Cost	$ 3,200
COST PER TON (15 tons)	$ 213.00

TABLE A-54

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY WASTE RECEIVING, SEGREGATION AND STORAGE MODULE

	Dollars
FIXED CAPITAL COST	$11,543,000
OPERATING COSTS, DAILY	
Labor	20,500
Supervision	3,788
Maintenance	2,664
Utilities	1,131
Laboratory Services	1,747
Overhead	1,021
Taxes and Insurance	977
	31,828
Capital Amortization	6,322
Total Daily Operating Cost	$ 38,150
AVERAGE COST PER TON (5,110 tons per day)	$ 7.47
AVERAGE COST PER 1,000 GALLONS OF AQUEOUS-INORGANIC WASTE (Basis: 9 pounds per gallon)	$ 33.60

TABLE A-55

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
AMMONIA STRIPPING MODULE

		Dollars
FIXED CAPITAL COST		$2,731,500
OPERATING COSTS, DAILY		
Labor		91
Supervision		23
Maintenance		630
Utilities		410
Laboratory Services		53
Overhead		242
Taxes and Insurance		231
		1,680
Capital Amortization		1,495
Total Daily Operating Cost	$	3,175
AVERAGE COST PER 1,000 GALLONS (82,000 mgd)	$	38.70
AVERAGE COST PER 1,000 GALLONS (1 mgd)	$	3.18

TABLE A-56

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
CHEMICAL TREATMENT MODULE

Chemical Oxidation of Cyanide Waste

		Dollars
FIXED CAPITAL COST		$1,408,000
OPERATING COSTS, DAILY		
Chlorine		7,191
Labor		251
Supervision		34
Maintenance		325
Utilities		410
Laboratory Service		40
Overhead		125
Taxes and Insurance		119
		8,535
Capital Amortization		771
Total Daily Operating Cost	$	9,340
AVERAGE COST PER 1,000 GALLONS (250,000 gpd)	$	37.40
AVERAGE COST PER 1,000 GALLONS (1 mgd)	$	9.34

TABLE A-57

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
CHEMICAL TREATMENT MODULE

Chemical Reduction of Chromium 6 Wastes

	Dollars
FIXED CAPITAL COST	$1,189,600
OPERATING COSTS, DAILY	
Sulfur Dioxide	4,600
Labor	129
Supervision	34
Maintenance	275
Utilities	410
Laboratory Service	40
Overhead	105
Taxes and Insurance	101
	5,694
Capital Amortization	652
Total Daily Operating Cost	$ 6,346
AVERAGE COST PER 1,000 GALLONS (344,400 gpd)	$ 18.40
AVERAGE COST PER 1,000 GALLONS (1 mgd)	$ 6.35

TABLE A-58

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
CHEMICAL TREATMENT MODULE

Neutralization-Precipitation

	Dollars
FIXED CAPITAL COST	$12,680,000
OPERATING COSTS, DAILY	
Lime	11,480
Flocculant	4,100
Hydrochloric Acid	443
Labor	391
Supervision	104
Maintenance	2,926
Utilities	410
Laboratory Services	40
Overhead	1,122
Taxes and Insurance	1,073
	22,089
Capital Amortization	6,945
Total Daily Operating Cost	$ 29,034
COST PER 1,000 GALLONS (1 mdg)	$ 29.00

TABLE A-59

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY

CHEMICAL TREATMENT MODULE

Metallic Sulfide Precipitation

	Dollars
FIXED CAPITAL COST	$1,433,000
OPERATING COSTS, DAILY	
Sodium Sulfide	11,890
Flocculant	2,050
Labor	117
Supervision	34
Maintenance	331
Utilities	410
Laboratory Service	40
Overhead	127
Taxes and Insurance	121
	15,120
Capital Amortization	785
Total Daily Operating Cost	$ 15,905
COST PER 1,000 GALLONS (1.74 mgd)	$ 9.14

TABLE A-60

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY LIQUID-SOLIDS SEPARATION MODULE

Primary Clarification and Filtration

	Dollars
FIXED CAPITAL COST	$11,355,000
OPERATING COSTS, DAILY	
Labor	73
Supervision	23
Maintenance	2,620
Utilities	410
Laboratory Services	36
Overhead	1,004
Taxes and Insurance	961
	5,127
Capital Amortization	6,219
Total Daily Operating Cost	$ 11,346
COST PER 1,000 GALLONS (1 mdg)	$ 11.50

TABLE A-61

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
LIQUID-SOLIDS SEPARATION MODULE

Secondary Clarification and Filtration

	Dollars
FIXED CAPITAL COST	$8,063,200
OPERATING COSTS, DAILY	
Labor	79
Supervision	23
Maintenance	1,861
Utilities	410
Laboratory Services	36
Overhead	713
Taxes and Insurance	682
	3,804
Capital Amortization	4,416
Total Daily Operating Cost	$ 8,220
COST PER 1,000 GALLONS (1.74 mdg)	$ 4.72

TABLE A-62

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY LIQUID-SOLIDS SEPARATION MODULE

Incinerator Scrubber Water Clarifier

	Dollars
FIXED CAPITAL COST	$11,408,300
OPERATING COSTS, DAILY	
Flocculant	2,050
Labor	79
Supervision	23
Maintenance	2,633
Utilities	410
Laboratory Services	36
Overhead	1,009
Taxes and Insurance	965
	7,205
Capital Amortization	6,248
Total Daily Operating Cost	$ 13,453
COST PER 1,000 GALLONS (738,000 gpd)	$ 18.20

TABLE A-63

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
LIQUID-SOLIDS SEPARATION MODULE

Brine Filtration

	Dollars
FIXED CAPITAL COST	$815,000
OPERATING COSTS, DAILY	
Chlorine	377
Labor	31
Supervision	10
Maintenance	188
Utilities	410
Laboratory Services	45
Overhead	72
Taxes and Insurance	69
	1,202
Capital Amortization	466
Total Daily Operating Cost	$ 1,668
COST PER 1,000 GALLONS (1.74 mgd)	$ 0.96

TABLE A-64

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
CARBON SORPTION MODULE

	Dollars
FIXED CAPITAL COST	$3,322,000
OPERATING COSTS, DAILY	
Labor	213
Supervision	23
Make-up Carbon	2,345
Utilities	443
Maintenance	767
Laboratory Services	107
Overhead	294
Taxes and Insurance	281
	4,473
Capital Amortization	1,819
Total Daily Operating Cost	$ 6,292
COST PER 1,000 GALLONS (1.74 mdg)	$ 3.62

TABLE A-65

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
SUBMERGED COMBUSTION EVAPORATION MODULE

	Dollars
FIXED CAPITAL COST*	$3,413,000
OPERATING COSTS, DAILY	
Labor	91
Supervision	23
Maintenance	788
Utilities	845
Fuel	11,700
Laboratory Services	40
Overhead	302
Taxes and Insurance	289
	14,078
Capital Amortization	1,869
Total Daily Operating Cost	$ 15,947
COST PER 1,000 GALLONS (1.74 mgd)	$ 9.16

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*Scale-up factor 0.9 for multiple units

TABLE A-66

PRELIMINARY COST ESTIMATE FOR LARGE SIZE FACILITY
INCINERATOR SYSTEM

	Dollars
FIXED CAPITAL COST	$17,201,700
OPERATING COSTS, DAILY	
Labor	706
Supervision	246
Maintenance	3,970
Power	2,271
Fuel	7,569
Laboratory Services	213
Overhead	1,522
Taxes and Insurance	1,456
	17,953
Capital Amortization	9,421
Total Daily Operating Cost	$ 27,374
COST PER TON (607)	$ 45.10

TABLE A-67

PRELIMINARY COST ESTIMATE FOR A SECURED LANDFILL

Capacity - 157 tons per day

	Dollars
FIXED CAPITAL COST	$ 1,970,000
OPERATING COST, DAILY	
Asphalt	942
Clay	4
Labor	1,585
Supervision	268
Maintenance	455
Utilities	214
Overhead	174
Taxes and Insurance	167
	3,809
Capital Amortization	1,079
Total Daily Operating Cost	4,888
4 percent Fee for State Administration	196
Total	5,084
COST PER TON	$ 32

TABLE A-68

PERSONNEL REQUIREMENTS FOR THE MEDIUM SIZE PROCESSING FACILITY

Personnel	Number
Plant Operators	78
Plant Supervisors	12
Laboratory Chemists/Chemical Engineers	4
Laboratory Technicians	6
Laboratory Supervisors	1
Security Guards	5
Mechanics	2
Electricians	2
Instrument Repairmen	2
Process Engineers	2
Secretaries	2
Plant Superintendent	1
	117

APPENDIX K

WASTE DISPOSAL PROCESS DESCRIPTORS

EVAPORATION

Evaporation is the removal of solvent as vapor from a solution or slurry. As a unit process this is normally accomplished by bringing the solvent to its boiling point to effect rapid vaporization. Heat energy must be supplied to the solvent and the vapor evolved must be continuously removed from above the liquid surface to prevent its accumulation. The vapor may or may not be recovered depending on its value. The end product may be a solid (upon cooling), but the transfer of heat in the evaporator must be to a solution or suspension of a solid in a liquid if the apparatus is not to be classified as a drier.[A-25]

A diagram of a simple evaporator system is given in Figure A-2.[A-26] Heat is transferred to the liquid in the evaporator from a heating coil through which steam passes. The steam condenses in the coil giving up its latent heat to the liquid to be evaporated. The vapor flows to a condensing coil which is cooled by circulating water, where it condenses, giving up its latent heat to the cooling water in the condenser. The concentrated solution or slurry in the evaporator is periodically or continuously drawn off after the desired solids level is attained.

Evaporation and distillation processes are widely used throughout industry for the concentration of solutions and for the production of pure solvents. Considerable research and development has been undertaken in recent years on the application of distillation processes to the production of potable water from sea water.

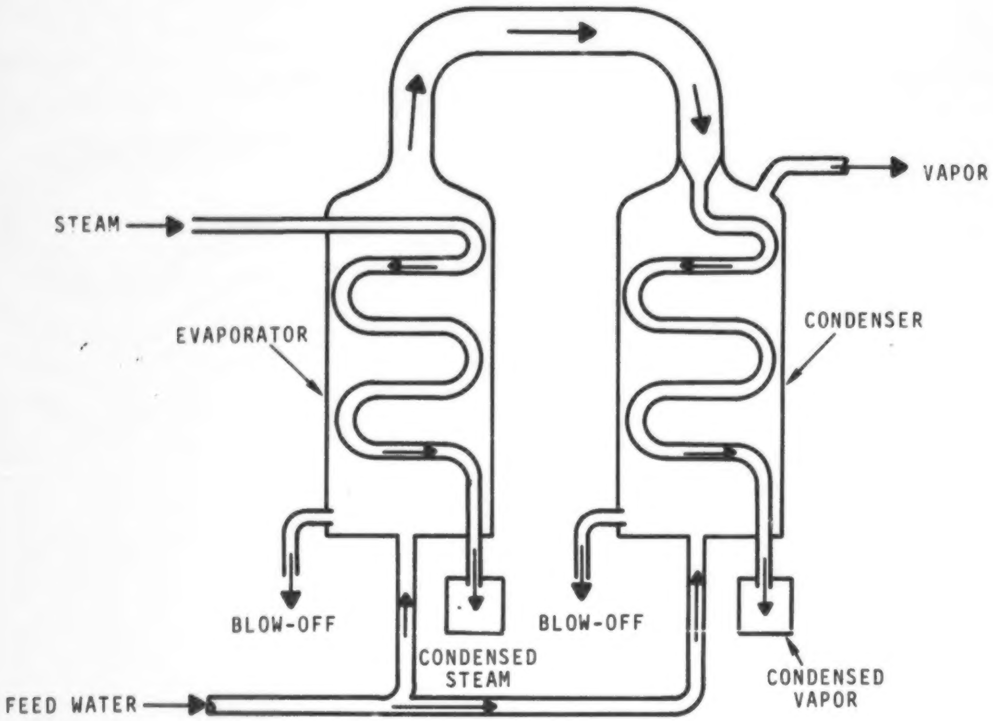
Operating Principles

The principal function of an evaporator is the transfer of heat to the liquid to be evaporated. It therefore follows that:

1. evaporation depends on the temperature difference between the heat source and the liquid to be evaporated. Greater temperature differences

FIGURE A-2

EVAPORATOR SYSTEM


STEAM
VAPOR
EVAPORATOR
CONDENSER
BLOW-OFF
BLOW-OFF
CONDENSED STEAM
CONDENSED VAPOR
FEED WATER

lead to greater heat transfer rates, all other conditions being equal;

2. evaporation depends on the exposed surface area available for transfer of heat. Large surface areas will transfer more heat than small surface areas, all other conditions being equal;

3. evaporation depends on the coefficient of heat transfer which is affected by the nature of the condensing steam, the tube wall, the boiling fluid, and any fouling agents present.

The design and operation of any evaporator are based on the control of these fundamental factors.[A-26]

An evaporator may be considered a special type of heat exchanger and the heat transfer rate predicted from the equation:

$$q = UA \Delta t$$

where U is the heat transfer coefficient, A is the surface area, and Δt is the temperature difference. The area may be either the area on which the steam is condensing or the area of the surface adjacent to the liquid solution. The reciprocal of the product of the overall coefficient and the area, 1/UA, is equal to the sum of the individual resistances of the condensing steam, the tube wall, the boiling fluid, and any fouling present. The resistances of both the condensing steam and the boiling fluid vary with position, so that 1/UA also varies. Further, the heat transfer coefficient in most types of evaporators is a strong function of the temperature difference Δ.[A-25]

The primary purpose served by a wastewater evaporator system is normally the concentration of the wastewater solids, dissolved and undissolved, although the distillate produced can be useful in many instances. If wastewater is supplied at a rate M_f and produces distillate at rate M_d, the rate of other material rejected from the system is M_f-M_d. If the original concentration of solids in the wastewater is represented by C_f, the original rate of total solids fed to the system is C_fM_f, so that the amount of water in the feed is M_f $(1-C_f)$. Hence, the amount of water in the reject stream is $M_f(1-C_f)-M_d$. The concentration of solids in this reject stream is now $C_fM_f/(M_f-M_d)$. The ratio of feed to distillate produced is M_f/M_d, which is usually called the feed ratio x_f. The concentration factor x_c is defined as $x_f/(x_f-1)$ and is the factor by which the initial wastewater solids concentration is multiplied to give the concentration of solids in the reject stream.[A-27] This reject stream is called the brine or evaporator blowdown, and the quantity M_f-M_d may be denoted by M_b.

The energy requirement for the evaporation of wastewater is generally a major item in operating costs. The absolute minimum of energy necessary to separate pure water from a salt solution is the effective heat of solution, λ, which is approximately 1.2 BTU/lb of distillate in the case of sea water evaporation.[A-27] In actual practice with any process more energy must be consumed and this energy must appear in the distillate and/or brine or must be rejected by some other device elsewhere in the system. In general, the energy balance includes such additional rejection as well as the temperature excess of brine and distillate above the feed. If, for example, wastewater is boiled in a simple, single effect (as in Figure A-2) evaporator system, it will be necessary to supply a latent heat of at least L_f to convert each pound of water into vapor and to extract L_d to condense that vapor into liquid water. The difference L_f-L_d, the latent heat of evaporation from the solution less the latent heat of condensation of the pure water, is in fact λ. But to condense the vapor to the desired product a cooling stream must be used to extract L_d, which must necessarily be rejected. Hence the total rejection per pound of distillate is L_d in the auxiliary stream. If, for simplicity, the distillate and brine products are at present assumed to be at the same temperature as the feed, then λ is the enthalpy difference of the products above the feed. Thus the total efflux enthalpy is $L_d+\lambda$, giving a total L_f, which is necessarily equal to the energy supplied.

In certain complex forms of the distillation process, which will be discussed later, it is possible to effectively use a substantial part of the latent heat L_d given out in condensing as a contribution to the latent heat L_f required for evaporation. Such use, generally called "regenerative", means that the actual energy supplied per pound of distillate product can be much less than L_f; this will be denoted by L_f/r. Again under the assumption that the end products are at the same temperature as the feed, λ is the only enthalpy difference of the products. Hence, there must be an auxiliary rejection loop or cooling stream as before, but this time rejecting $(L_f/r) - \lambda$, so that the total outlet energy will balance the total input L_f/r.

In a distillation plant of finite size, it is impossible to have the brine and distillate products brought back to the feed temperature (except in the unlikely event that the air temperature is consistently below the sea temperature so that air can be used as a coolant). Hence, in general $s_b(t_b-t_f)$ and $s_d(t_d-t_f)$ must be written for the enthalpy contents of reject brine and distillate, respectively, in addition to λ. (Symbols S_b and S_d denote specific heats of brine and distillate, respectively, and t_b, t_d, and t_f denote temperatures of brine, distillate, and feed respectively.) Thus, if the auxiliary cooling loop rejects q_a of heat per pound of distillate made, the energy balance for this system is

$$\frac{M_d L_f}{r} = M_d q_a + M_d \lambda + M_b s_b (t_b - t_f) + M_d s_d (t_d - t_f)$$

Therefore,

$$\frac{L_f}{r} = q_a + \lambda + s_d (t_d - t_f) + \frac{M_b}{M_d} s_b (t_b - t_f)$$

But,

$$\frac{M_b}{M_d} = \frac{M_f - M_d}{M_d} = x - 1$$

Hence,

$$r = \frac{L_f}{q_a + \lambda + s_d (t_d - t_f) + (x_f - 1) s_b (t_b - t_f)}$$

or

$$q_a = \frac{L_f}{r} - \lambda - s_d (t_d - t_f) - (x_f - 1) s_b (t_b - t_f)$$

It is customary to refer to a characteristic R, called the performance ratio of the plant. This is defined precisely as the number of pounds of distillate produced per 1000 Btu of heat input. Hence,

$$R = \frac{1000 M_d}{\text{heat input}}$$

Earlier we defined L_f/r as the heat input per pound of distillate produced. Hence,

$$R = (1000\ L_f) r$$

Since L_f is of the order of 1000 Btu/lb, R and r have the same order of magnitude, and each is an approximate measure of the other. Moreover, since r is defined from the relation heat input per pound of distillate product = L_f/r,

it represents the number of pounds of distillate obtained from a heat input of L_f, i.e., from the latent heat of evaporation of 1 lb of vapor from water. Thus, r is conventionally named the gained output ratio of the plant.

Process Design

No generalization can be made which will serve as a reliable guide in the selection of the optimum type of evaporator and its auxiliaries. Factors which must be considered in the selection of the type of evaporator most suitable for waste liquid processing are: (1) characteristics of the feed, such as composition and amount of dissolved materials and their salting, scaling, corroding and foaming characteristics; (2) amount of liquid to be treated per hour and it fluctuations, and number of daily working hours involved; (3) volume reduction and decontamination factor required; (4) ease of maintenance; (5) space limitations; and (6) economic limitations.[A-28]

Coil or Pot Type Evaporator

This type of evaporator is now seldom used in the chemical industry but is frequently used for processing radioactive wastes, especially for small installations. A coil type evaporator in a simplified form is illustrated in Figure A-2. Pot type evaporators are simply constructed and may be useful for simple batch operation. In a small installation with a small heat load a jacketed kettle may be used.

Horizontal-Tube Evaporator

The horizontal tube evaporator was widely used for more than 50 years in the chemical industry but is seldom used now except for boiler feed water preparation. The distinguishing features in the design of this evaporator are the shape and arrangement of the evaporator tubes. The tube bundle is normally submerged. One type of horizontal tube evaporator is illustrated in Figure A-3.

Vertical-Tube Evaporator

The vertical tube evaporator, as illustrated in Figure A-4 is widely used throughout industry. The body is normally a cylinder and the heating surface is provided by short tubes, usually 2 to 3 inches in diameter, through the steam chest at the bottom of the vessel. This type of evaporator gives high heat transfer coefficients at high temperature differences, but as temperature differences decrease heat transfer becomes poor.

FIGURE A-3

HORIZONTAL-TUBE EVAPORATOR

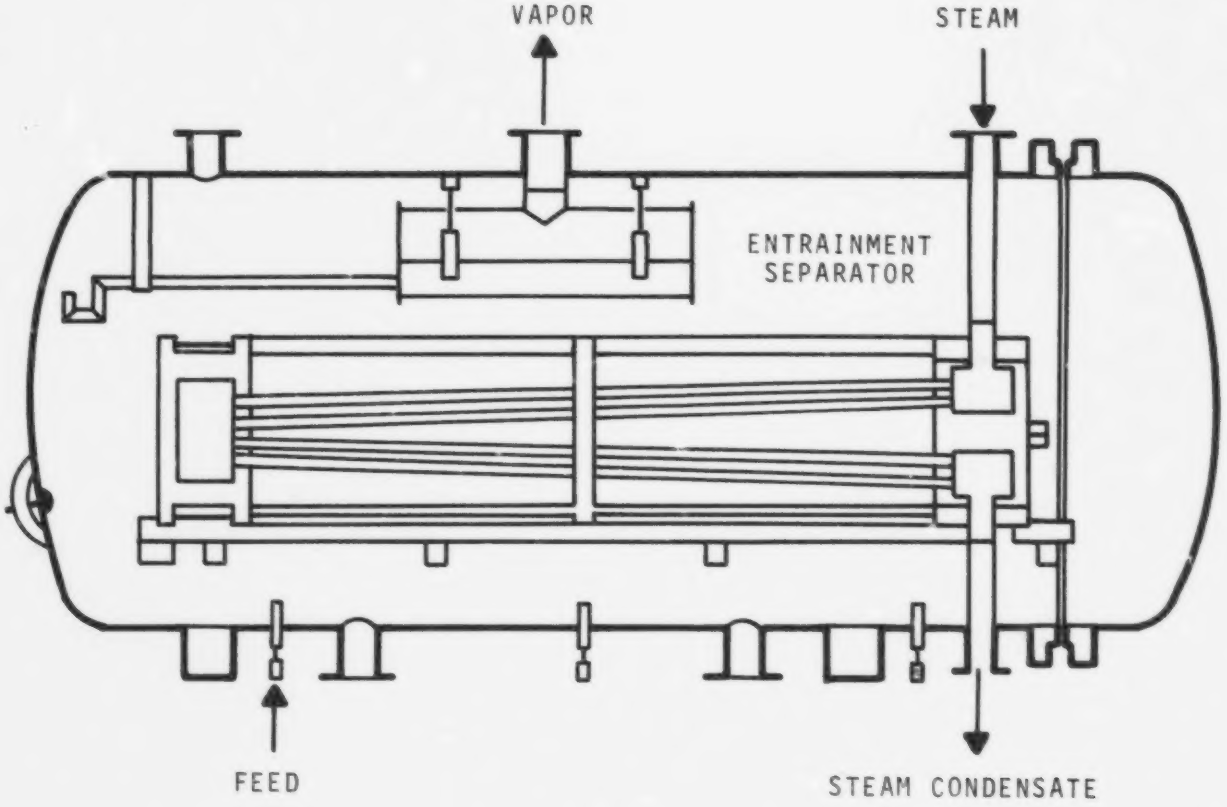
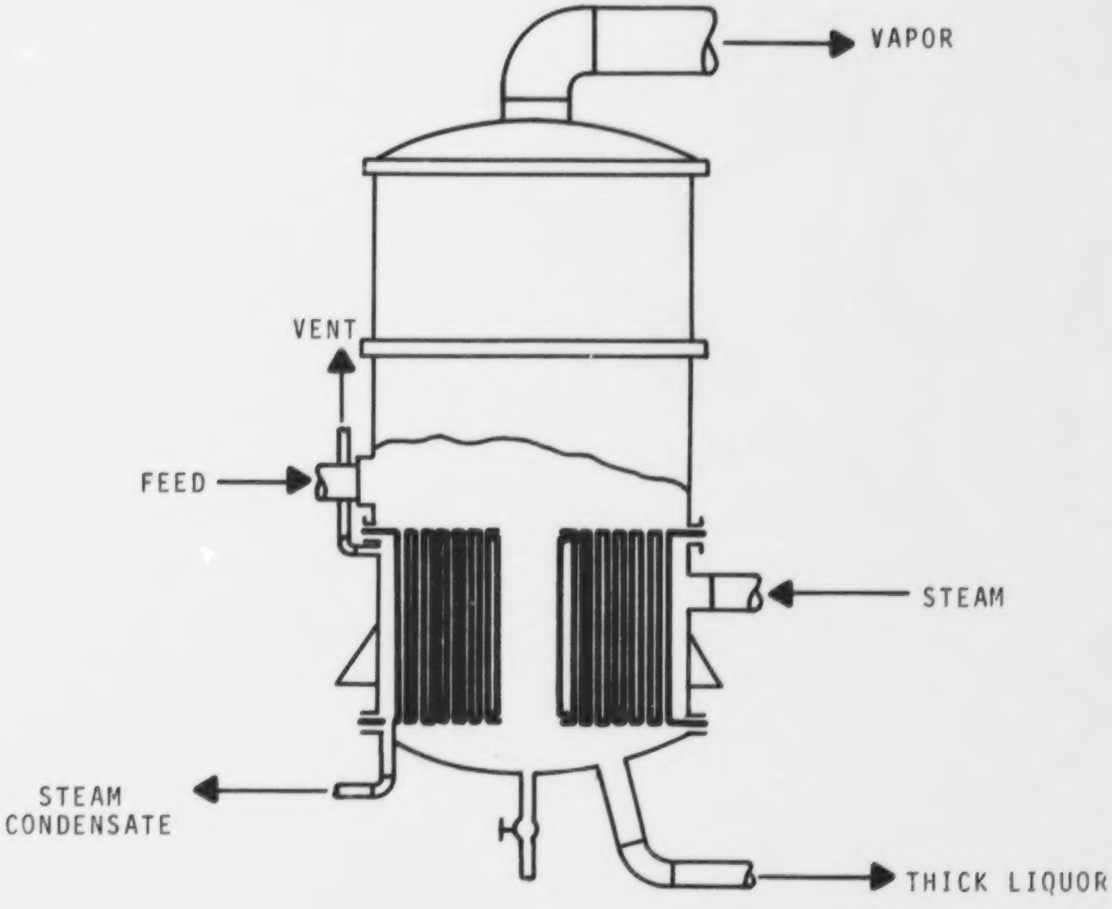

VAPOR
STEAM
ENTRAINMENT SEPARATOR
FEED
STEAM CONDENSATE

FIGURE A-4

VERTICAL-TUBE EVAPORATOR


VAPOR
VENT
FEED
STEAM
STEAM CONDENSATE
THICK LIQUOR

Liquid circulation past the heating surface is induced by the pumping action of water vapor formed in the tubes.

The return passage from above the steam chest to the bottom space is usually a cylindrical downtake. Its cross-sectional area should be of the same order of magnitude as the total cross-sectional area of the tubes. This arrangement is the most commonly used standard vertical evaporator, but a variation without downtake called the "basket-type" is also used. Because the natural recirculation rate is many times the feed rate, the liquid entering the bottom section is of the same concentration as the product removed in continuous operation. The circulating velocity and heat transfer rate are strongly affected by the liquid level. The highest heat-transfer coefficients are achieved when the level, as indicated by an external gage glass, is only about halfway up the tubes. A slight reduction in level below the optimum results in incomplete wetting of the tube walls with a consequent increased tendency to foul and a rapid reduction in capacity.

When scaling or salting liquids are to be evaporated it is customary to operate with the liquid level appreciably higher than the optimum. To remove scale, the tubes are subjected to cleaning by mechanical devices which limit the length of the tubes. The standard vertical tube evaporator is versatile and relatively inexpensive.

Forced-Circulation Type

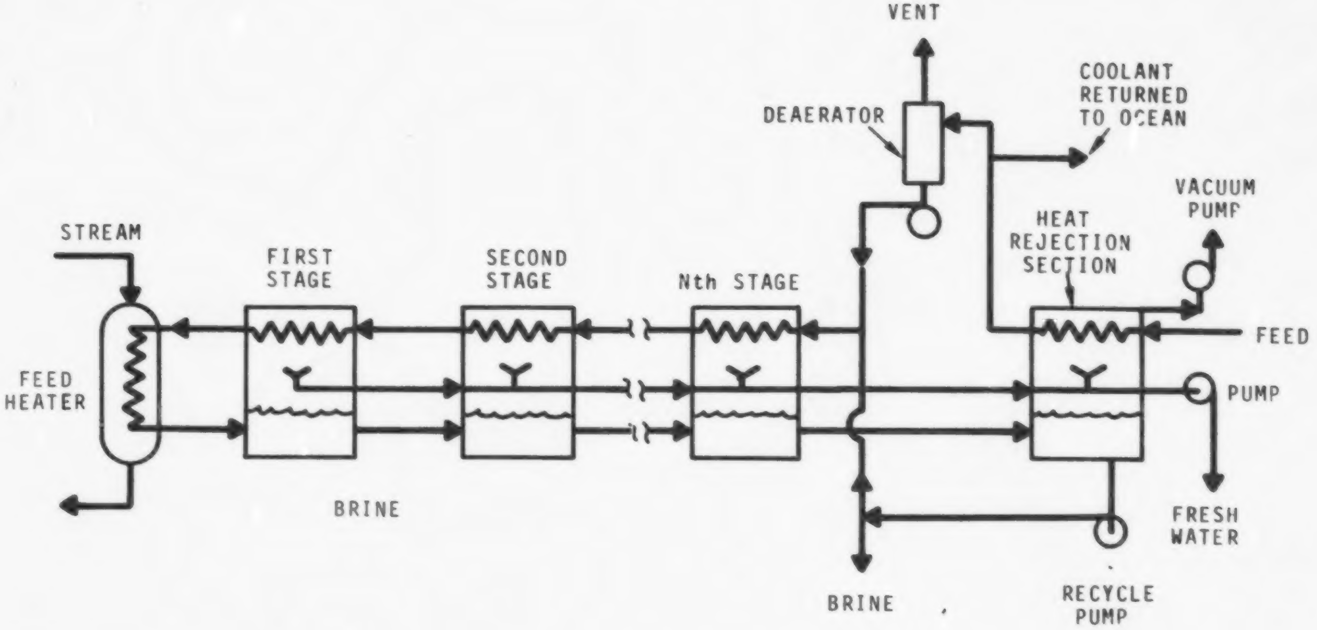
Liquid is circulated by a pump through the heating tubes at relatively high velocities in this type of evaporator with relatively little evaporation occurring per pass. Scale deposition on the heat exchange surfaces is low and heat transfer is high due to the high velocities of the liquid. The heating element is generally contained in a separate unit and the tubes may be either vertical or horizontal.

Multistage Flash Type

Multistage flash distillation (MSF) was successfully developed early in the saline water conversion program. MSF plants accounted for more than two-thirds of the total production capacity of plants of all sizes built since 1951, according to a United Nations survey issued in 1969.[A-29] A simplified flow diagram of the MSF process is shown in Figure A-5. Heated brine flows through a series of chambers at successively lower pressures while water vapor flashes off in each chamber and condenses on the surfaces of heat exchange tubes. The heat exchange tubes in the chambers contain brine which flows back to the feed heater. The returning brine captures the heat of

FIGURE A-5

MULTISTAGE FLASH EVAPORATOR


VENT
DEAERATOR
COOLANT RETURNED TO OCEAN
VACUUM PUMP
HEAT REJECTION SECTION
STREAM
FIRST STAGE
SECOND STAGE
Nth STAGE
FEED
FEED HEATER
PUMP
BRINE
FRESH WATER
BRINE
RECYCLE PUMP

condensation in each of the flash chambers and thereby minimizes the thermal input to the system. Scaling problems are reduced because no evaporation takes place on the heat exchange surfaces.

Multiple-Effect Type

Multiple-effect distillation generally refers to a system in which the heat of condensation from one "effect" is used to evaporate water in the succeeding "effect". A simple multiple-effect system is illustrated in Figure A-6. Water enters the first effect where it is heated and evaporated. The vapor from this effect is condensed in the second effect, which also boils. Each effect is operated at a lower pressure than the previous one, and the pressure changes correspond to the difference required to produce the flow of heat needed. The heat transfer limitations of submerged-tube distillation require temperature driving forces of around 25°F per effect and are therefore limited to a few effects.

The vertical tube evaporation (VTE) (multiple-effect distillation) process was selected by the Office of Saline Water to demonstrate the economic feasibility of multiple-effect distillation. Superior heat transfer is obtained by allowing water to fall through heat exchange tubes heated by steam which is admitted into the space around and outside of the tube bundle of the effect. Hot vapor and brine emerge at the bottom of the first effect. The hot brine is pumped to the top of the second effect and falls through tubes arranged vertically in this effect. The vapor produced in the first effect is condensed in the second effect, producing fresh water. This process is repeated in each effect, producing both fresh water and heated brine.

Vapor Compression Distillation

Vapor compression distillation is based on the principle that when a vapor is compressed, its temperature rises. It then becomes possible to condense the vapor at a higher temperature and use the latent heat to evaporate more liquid. An elementary flow diagram of this process is shown in Figure A-7. Saline water is pumped into a heat exchanger within an evaporator chamber where it is boiled. Vaporizing fresh water is piped to a compressor where its heat content is raised by compression. The compressed vapor then flows through the heat exchanger giving up its latent heat to the boiling saline water and is condensed to fresh water. This method makes use of the fact that the saturation vapor pressure of water increases with pressure, so that by compressing the vapor, the subsequent condensation will be high enough to cause the evaporation of more

FIGURE A-6

MULTIPLE EFFECT EVAPORATOR

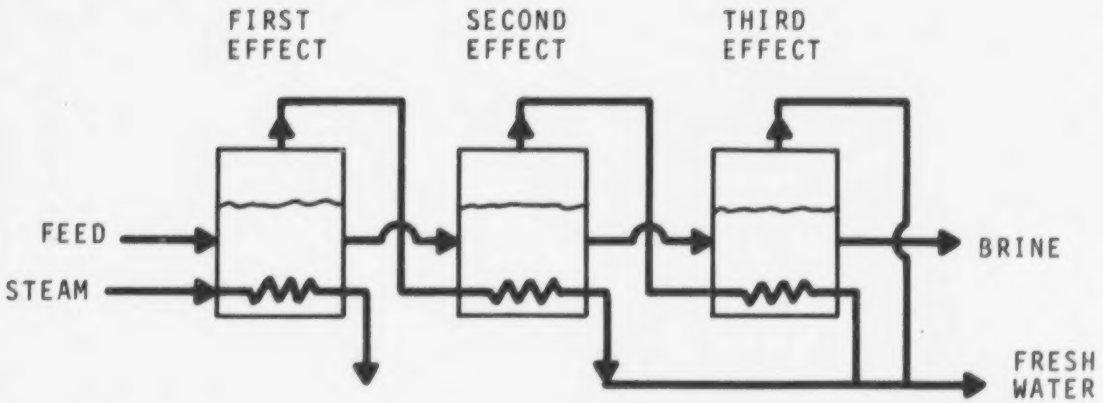
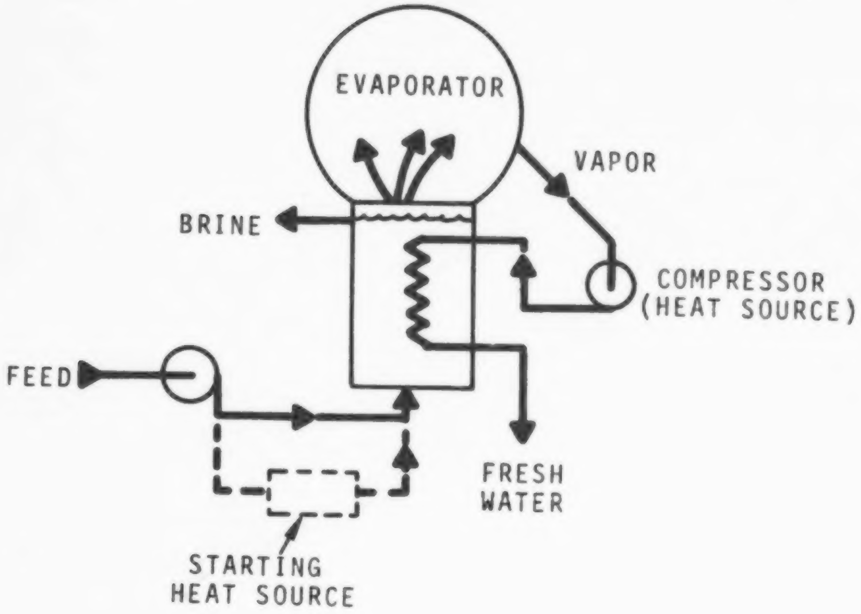

FIRST EFFECT
SECOND EFFECT
THIRD EFFECT
FEED
STEAM
BRINE
FRESH WATER

FIGURE A-7

VAPOR COMPRESSION EVAPORATOR


EVAPORATOR
VAPOR
BRINE
COMPRESSOR (HEAT SOURCE)
FEED
FRESH WATER
STARTING HEAT SOURCE

water. The energy input to this system is very low compared to other distillation processes. The vapor compression process generally requires no auxiliary heat source for operation, except for starting, other than that supplied through the motor driven compressors. Starting heat in the form of steam is supplied by a small boiler.

Wiped-Film Type

This type of evaporator might be classed as a forced-circulation type because it uses mechanical energy to improve heat transfer. The heating surface consists of a single (vertical type) or tapered (horizontal type) cylinder of large diameter in which an agitating blade or series of wipers rotates. The liquid waste fed into the cylinder is agitated vigorously by the rotating blades, becoming filmy by centrifugal force, and flows along the heating surface. The continuous formation of the film permits a much higher concentration of thick liquor than can be handled in other types of evaporators.

Submerged-Combustion Type

Submerged combustion evaporation utilizes combustion gases in direct contact with the liquid to be evaporated as a means of heat transfer. It may consist simply of a tank to hold the liquid and a burner that can be lowered into the liquid. Because there are no heating surfaces on which scale can deposit, this device is well-suited for use with severely scaling liquids.

Another type of submerged combustion evaporator[A-31] is shown in Figure A-8. Fuel gas and air are mixed and then fired by a high energy release burner into a combustion chamber. Hot combustion products from this chamber are exhausted through a small port. The liquid to be evaporated is injected at a controlled rate from an annular feed chamber jacket in the exhaust port of the combustion chamber. A complete exchange of heat takes place instantly as the liquid stream enters the exhaust gas stream.

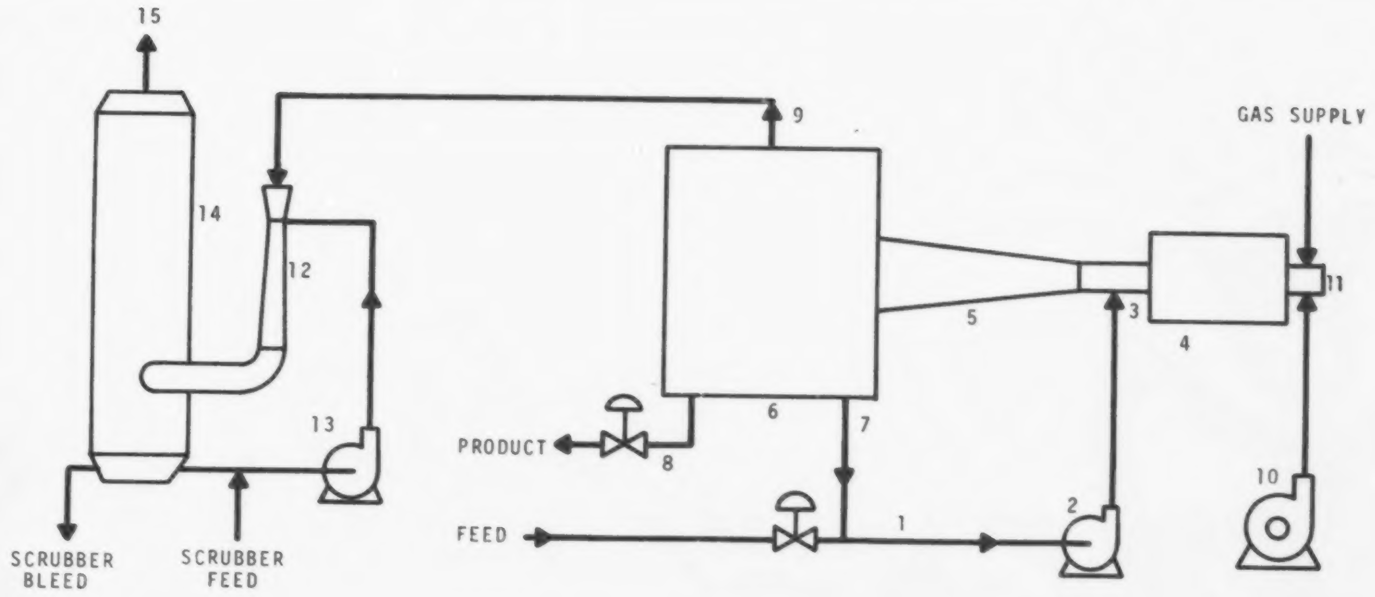
The heated product is separated from the quenched gas stream in a cyclonic separator. Spent gases are exhausted and the product is collected and drawn off for ultimate disposal and for recycling with feed.

Solar Evaporation

Solar evaporation ponds are feasible only where annual evaporation exceeds annual rainfall by more than 20 inches, as it does in areas of the far West.[A-31] In many arid areas it is possible to evaporate brines to dryness in properly lined solar evapora-

FIGURE A-8

SUBMERGED COMBUSTION EVAPORATOR


15
9
GAS SUPPLY
14
12
11
5
3
4
13
6
7
PRODUCT
8
10
2
FEED
1
SCRUBBER BLEED
SCRUBBER FEED

1. CIRCULATING SYSTEM
2. CIRCULATING PUMP
3. FEED CHAMBER
4. COMBUSTION CHAMBER
5. VENTURI
6. SEPARATOR
7. RECIRCULATION
8. PRODUCT DISCHARGE
9. EXHAUST DUCT
10. COMBUSTION AIR BLOWER
11. BURNER
12. MODIFIED VENTURI SCRUBBER
13. SCRUBBER CIRCULATING PUMP
14. SCRUBBER SEPARATOR SECTION
15. EXHAUST

tion ponds. The ponds may be abandoned after use by placing a suitable cover material over the surface to prevent wind erosion of the salts. Contamination of groundwater is unlikely due to negligible infiltration of rainfall into deep soil layers.

Process Economics

Major factors governing evaporation process economics include the cost of equipment and installation, the cost of fuel or steam, and the cost of operating labor. The estimated cost data for one type of evaporation process, multistage flash, are given in Table A-69 for a 100,000 gpd plant evaporating wastewater from 0.7 percent to 10 percent total dissolved solids. Estimated costs are based on published data (1970)[A-31] updated to 1972 using the Chemical Engineering Plant Cost Index.

Process Modifications

Process modifications include feed stream pretreatment to control corrosion, scaling and foaming. Acids or bases frequently are added to adjust the pH of the feed to the optimum level to control corrosion and/or scaling (e.g., calcium carbonate deposition). Ion exchange and/or cold lime softening are also used to remove scale forming elements such as calcium and magnesium. Scale forming inhibitors such as polyphosphates are frequently employed. Foaming can be controlled through the use of various antifoam agents.

Deentrainment devices are employed where it is desirable to minimize the carryover of entrained salts into the distillate. These are particularly important with respect to the evaporation of radioactive wastes where high decontamination factors between the feed and the distillate are necessary to meet discharge standards for radioisotopes.

Process Applicability

Evaporation represents the most versatile wastewater processing method available that is capable of producing a high quality effluent. It is, however, one of the most costly processes and is therefore generally limited to the treatment of wastewaters with high solids concentrations or to wastewater where very high decontamination is required (radioactive wastes). Many examples are available throughout industry which illustrate the use of this process. One example is discussed below which involves the treatment of high salt, radioactive wastes at the U.S. Atomic Energy Commission's Hanford facilities in the State of Washington.[A-32]

A hot air sparge evaporator has been employed at Hanford to concentrate radioactive wastes to salt cakes. This evaporator is

TABLE A-69

ESTIMATED COST DATA ON MSF EVAPORATION PROCESS AT 100,000 GPD FLOW

Capital Cost, dollars (including installation)	174,000[(a)]
Operating Cost	
Steam, (lb/hr)	(3,300)
$/day @ $0.46/10^6 Btu	36.5
Electricity, (kw)	(30)
$/day @ 12 mills/kwh	8.7
Operating Labor, $/day	167.0
Maintenance and Supply, $/day	2.0
Total Daily Operating Cost, $/day	214.2

(a) Does not include the boiler cost, which is included in steam cost.

similar to a submerged combustion type except that hot air is used in place of gaseous combustion products. The process is operated by introducing electrically heated air through an air lift circulator located in a large underground tank. The off-gases leaving the high salt solution in the concentration tank are unsaturated with respect to pure water and contain entrained radionuclides which must be removed prior to release on noncondensables to the atmosphere. A diagram of the process is given in Figure A-9.

A typical waste feed composition is as follows:

NaOH - 2.1 $\underline{M}$

$NaAlO_2$ - 0.5 $\underline{M}$

$NaHO_2$ - 1.5 $\underline{M}$

$NaNO_3$ - 1.1 $\underline{M}$

pH - 12.5

Sp. Gr. - 1.14

^{137}Cs - 0.03 Curies/gal

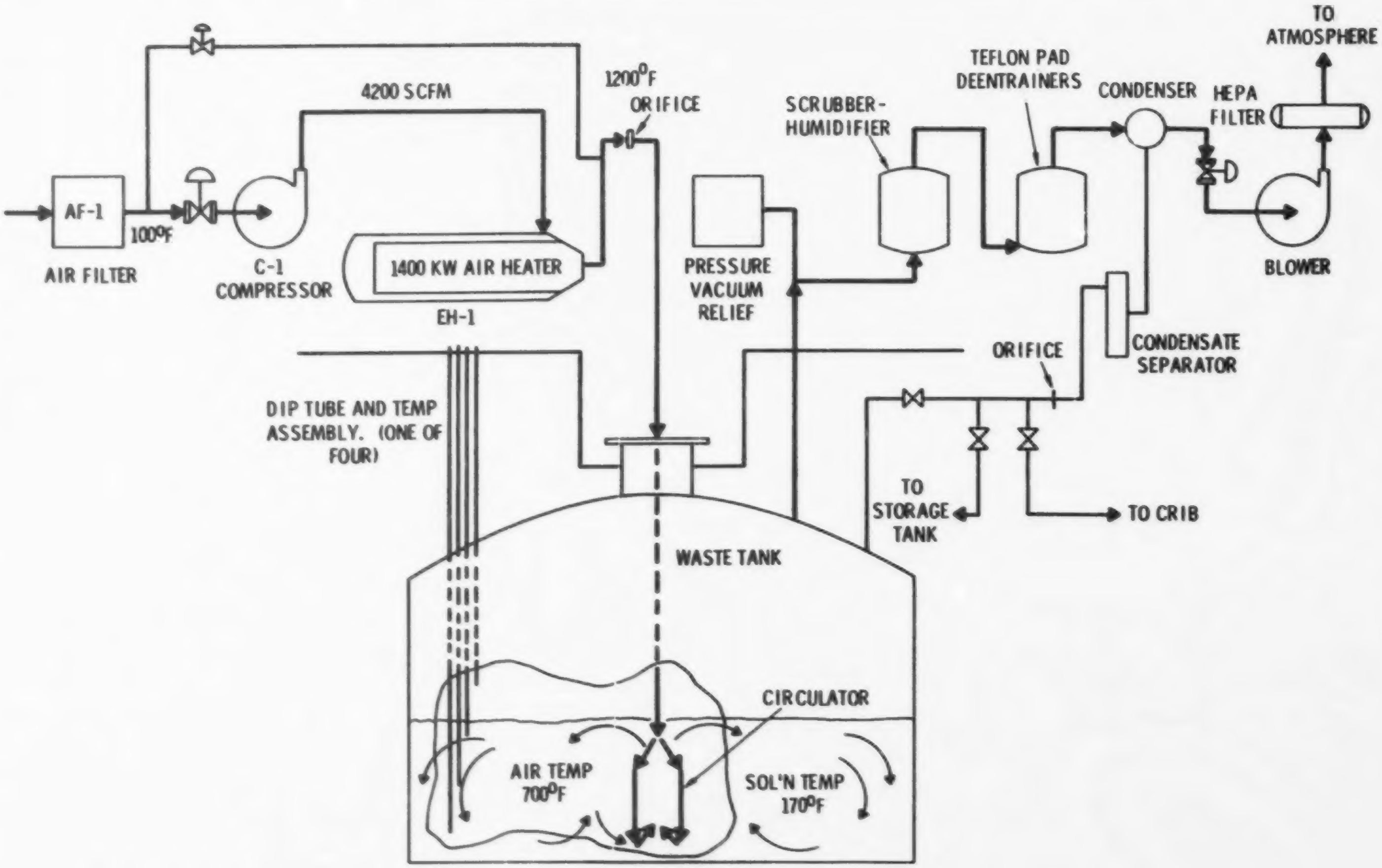
The waste is concentrated to approximately 25 percent of its original volume, which results in crystallization of many of the salts contained therein.

CARBON ADSORPTION

Adsorption is said to occur when a substance is brought into contact with a solid and held at the surface of the solid by physical and/or chemical forces. The solid is called the adsorbent and the adsorbed substance is the adsorbate. The amount of adsorbate held by a given quantity of adsorbent depends upon several factors including the surface area per unit volume (or weight) of the adsorbent and the intensity of the attractive forces. The situation is more complicated when a liquid containing two or more substances is brought into contact with the solid adsorbent. In this case competitive forces exist between the solvent and the dissolved solute and between the solute (adsorbate) and the adsorbent which determine the quantity and rate at which the solute molecules are removed from the liquid stream by the solid. Activated carbon, which is produced from an organic material that has been carbonized and subjected to a controlled oxidation (activation) process to increase surface area and develop a very porous structure, has been widely used to remove organic and other contaminants from water. It has

FIGURE A-9

HOT AIR SPARGE EVAPORATOR


TO ATMOSPHERE
TEFLON PAD DEENTRAINERS
CONDENSER
HEPA FILTER
4200 SCFM
1200°F
ORIFICE
SCRUBBER-HUMIDIFIER
AF-1
100°F
AIR FILTER
C-1 COMPRESSOR
1400 KW AIR HEATER
EH-1
PRESSURE VACUUM RELIEF
BLOWER
ORIFICE
CONDENSATE SEPARATOR
DIP TUBE AND TEMP ASSEMBLY. (ONE OF FOUR)
TO STORAGE TANK
TO CRIB
WASTE TANK
CIRCULATOR
AIR TEMP 700°F
SOL'N TEMP 170°F

been used to remove dissolved refractory (i.e. biologically resistant) organics from municipal waste streams[A-33] and to clean up industrial waste streams.[A-34] Also, activated carbon has been shown to remove some heavy metals and other inorganics from water.[A-35,A-36] Usually, economical application of activated carbon for wastewater treatment requires some method for regenerating the carbon. This can involve contacting the carbon with a solvent which has a higher attraction for the adsorbed material than does the carbon, resulting in desorption. More often, however, the carbon is thermally regenerated in a furnace under controlled oxidizing and temperature conditions. Thermal regeneration of carbon is particularly applicable for large plants and for those treating wastes containing a variety of compounds.

The usual treatment technique involves the use of columns or beds of granular carbon similar to the columns used for ion exchange. This can take the form of parallel (Figure A-10) or series (Figure A-11) operation of the carbon beds, depending upon the concentration of the containment and the degree of removal required. Thermal regeneration requires the removal of the carbon from the bed upon exhaustion, whereupon it is regenerated and returned to the bed for further service (Figure A-12).

Operating Principles

The attractive power of the solid surface in carbon adsorption has been compared to the solubilizing power of a liquid at a liquid-liquid interface such as between ether and water. If the aqueous phase of the ether-water system contained a contaminant such as propyl alcohol, the nonpolar ends of the alcohol molecules would be attracted to the ether layer, whereas the polar ends of the alcohol molecules would be attracted to the water layer (like dissolves like). The result would be a concentration of propyl alcohol at the ether-water interface with the molecules oriented so that the polar ends extended into the aqueous layer and the nonpolar ends into the ether layer. A similar effect occurs at the surface of activated carbon where the nonpolar or nonpolar ends of organic molecules are attracted or "dissolved". Generally, the more nonpolar a molecule is or the longer its nonpolar "tail", the stronger the attraction to the carbon surface. Also, it becomes obvious that the removal capacity of the carbon depends upon its surface area per unit volume (or weight). There is, however, often a limit beyond which an increase in specific surface area does not result in increased adsorption.[A-36] In general, the factors influencing adsorption at the carbon-liquid interface are given below in Table A-70:

FIGURE A-10

PARALLEL OPERATION

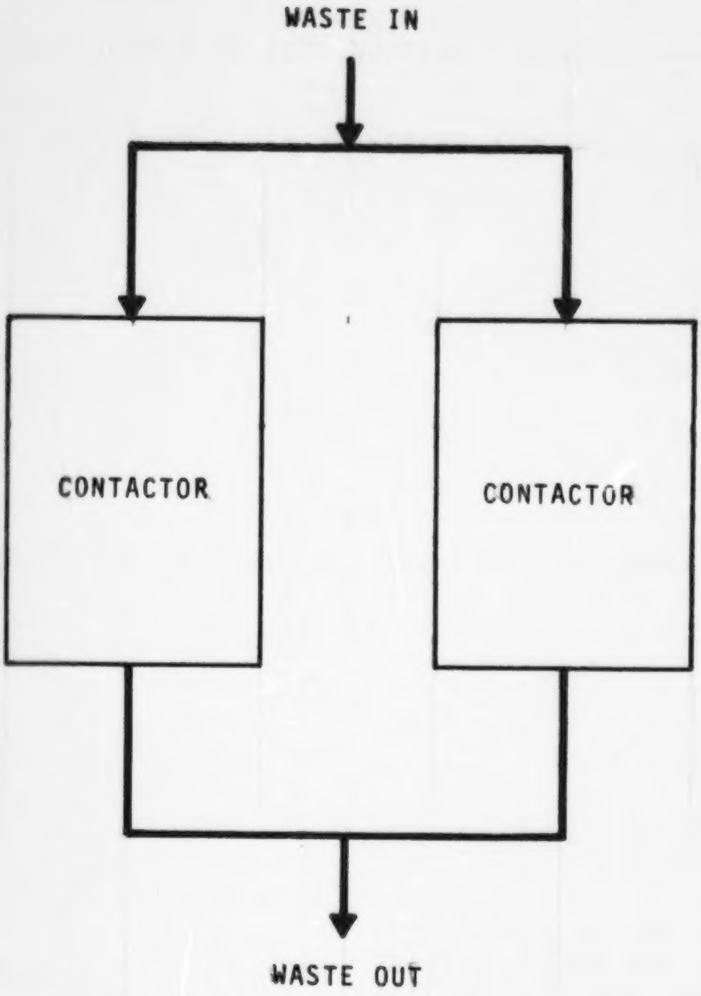
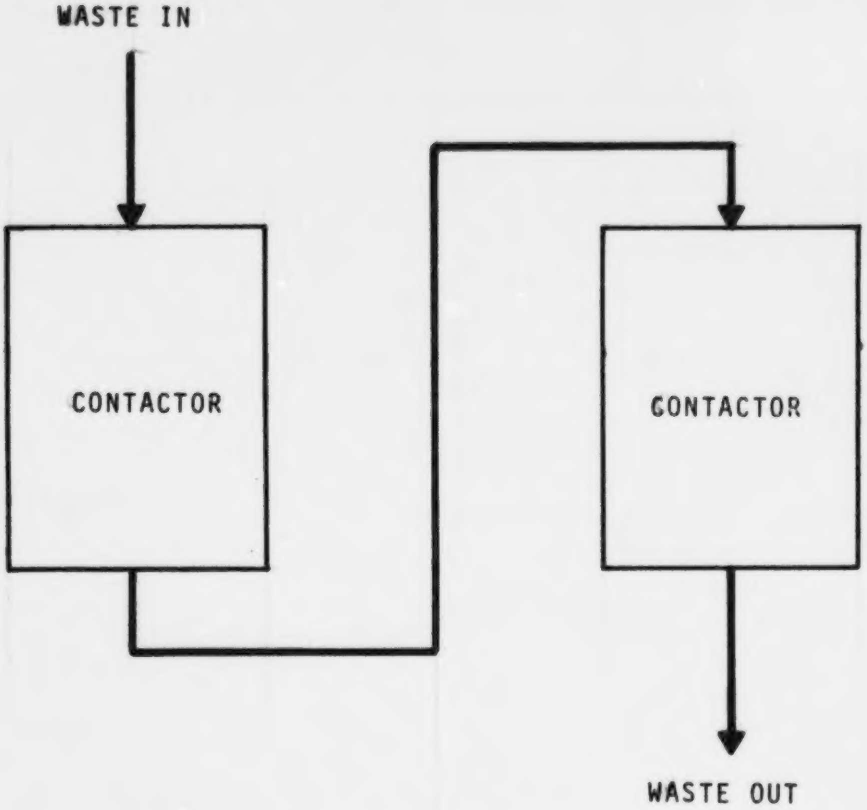

WASTE IN
CONTACTOR
CONTACTOR
WASTE OUT

FIGURE A-11

SERIES OPERATION


WASTE IN
CONTACTOR
CONTACTOR
WASTE OUT

A-12

FIGURE A-12

CARBON REGENERATION SYSTEM

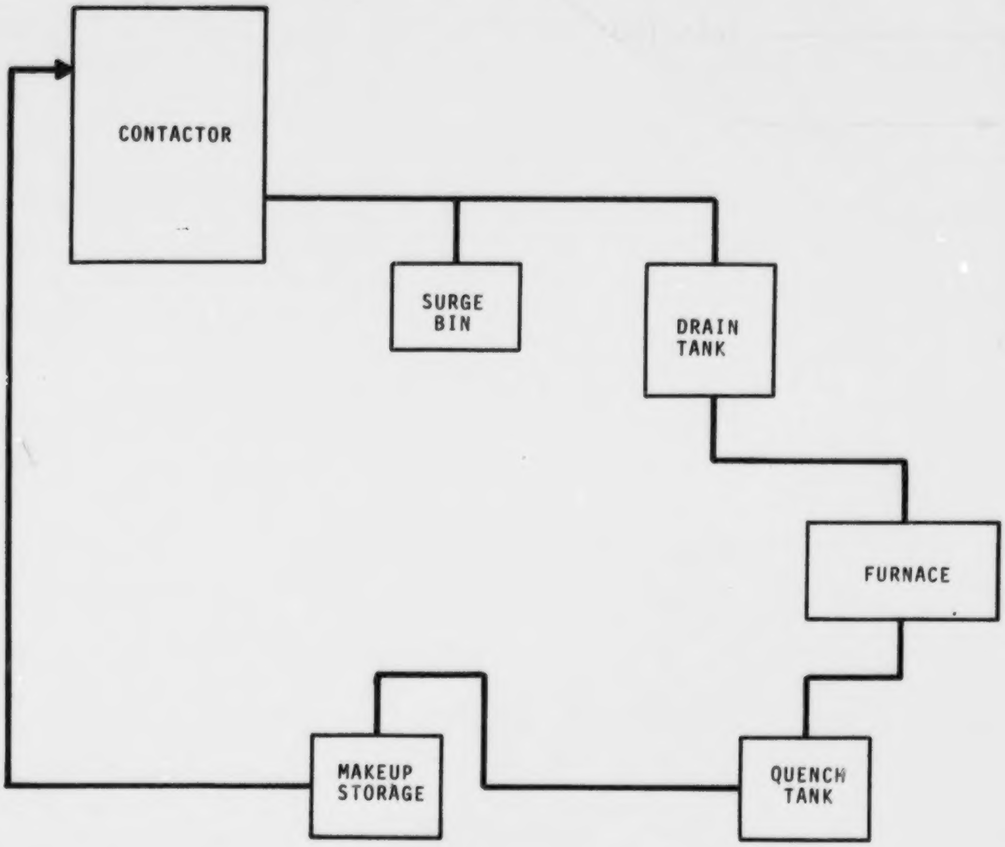

CONTACTOR
SURGE BIN
DRAIN TANK
FURNACE
QUENCH TANK
MAKEUP STORAGE

TABLE A-70[A-36]

FACTORS INFLUENCING ADSORPTION AT CARBON LIQUID INTERFACE

- Attraction of carbon for solute
- Attraction of carbon for solvent
- Solubilizing power of solvent for solute
- Association
- Ionization
- Effect of solvent on orientation at interface
- Competition for interface in presence of multiple solutes
- Interactions of multiple solutes
- Coadsorption
- Molecular size of molecules in the system
- Pore size distribution in carbon
- Surface area of carbon
- Temperature

The adsorption of inorganic substances is quite variable. Some strong electrolytes show little adsorbability whereas others are adsorbed to a high degree. (Table A-71 gives some inorganic substances adsorbable by activated carbon.) The mechanisms of inorganic adsorption are even less well understood than those for organic adsorption.

TABLE A-71[A-36]

SOME INORGANIC SUBSTANCES ADSORBABLE BY ACTIVATED CARBON*

Iodine

Gold Chloride

Permanganates

Dichromates

Mercuric Chloride

Molybdates

Ferric Salts

Arsenates

Silver Salts

---

*The extent of adsorption of many inorganic substances is greatly influenced by pH of the solution.

One mechanism appears to be chemical reduction, an example being the reduction of halogens, possibly to halides. In the case of some heavy metals, it has been shown that the metal ion has been reduced to the elemental metal which is deposited in the pores of the carbon. In that case, thermal regeneration may not return the carbon to the expected state.

A second possible mechanism for removing inorganics from water involves the process of co-adsorption, wherein organic or other material in the water is adsorbed onto the carbon and assists in attracting the inorganic material. This may occur by complex formation or other means. The relationship of pore size and molecule size can be important in "trapping" the molecule or ion in the carbon. Lastly, the simple filtering effect of the carbon for solid particles may be important, particularly if the pH of the water changes within the bed due to biological action.

Usually the regeneration furnace is fitted with a scrubber and afterburner to eliminate possible particulates and organic vapors. This approach has allowed the thermal regeneration of activated carbon to result in final disposal while at the same time meeting most air pollution requirements.[A-33,A-37]

Process Design

Probably the most important items to consider at the beginning of a carbon adsorption design are the rate and efficiency of adsorption and the ultimate loading capacity of the carbon expressed perhaps as mg of contaminant per gram of carbon. This information can be obtained by the isotherm test. The Swindell-Dressler Company, in a report for the EPA[A-37] has described the isotherm test and its interpretation.

> *An adsorption isotherm is a batch adsorption test performed in the laboratory under standardized conditions. It will be valid only for the temperature at which it is run, which should correspond to the temperature normally encountered in the wastewater. The isotherm test actually consists of a series of individual batch tests which differ only in one respect, e.g., carbon dosage. Different carbons may also be compared by running their respective series of batch tests at the same time, or in succession using the same batch of feedwater. Each individual batch test is run in a shaker or beaker with an attached mixer. Organics are measured before and after contacting the feedwater with the carbon. Interpretation of the test results is discussed below.*
>
> *The wastewater used for the isotherm test should be the same feed as that to be treated in the full-scale plant. If preliminary chemical clarification is planned, then the isotherm feed should be clarified with the same coagulant at the same pH, and then readjusted to whatever pH is deemed suitable for plant operation and discharge.*
>
> *Selection of carbon dosages may be somewhat arbitrary at first. It is usually necessary to run several tests in succession to identify the range of dosages which will give the best isotherm results. The final isotherm plot must consist of adsorption data collected at one time on the same batch of wastewater. Either TOC or COD is an acceptable organic parameter by which to evaluate the results of an isotherm test.*

The procedure for the isotherm test need not be described in detail here since it may be found in many places in the literature....

The adsorption data may be evaluated by using a logarithmic plot of: organics removed per unit dose of adsorbent versus residual organic concentration. The following example should serve to describe the procedure:

Carbon dosage (M) (g/l)	Residual COD (C_f) (mg/l)	$X=C_o-C_f$	X/M
0	130(=C_o)	-	-
0.25	86	44	176
0.50	73	57	114
1.00	69	61	61
2.50	45	85	34
5.00	33	97	19

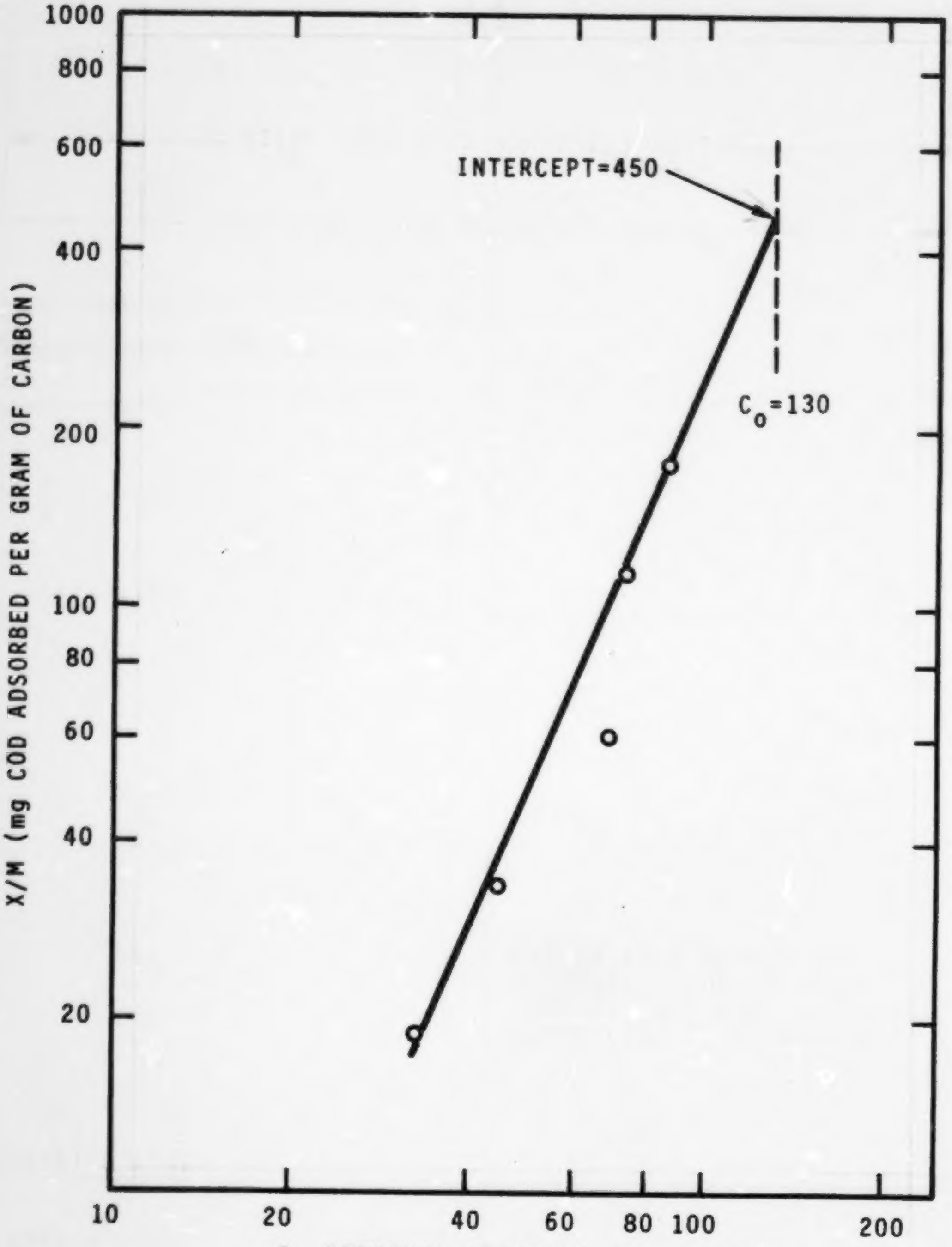
plot log X/M versus log C_f

The plot is shown in Figure A-13. The isotherm plot should be linear, but frequently deviates from this ideal. Straight lines may be drawn through many data sets without trouble. Individual deviant points may be discarded as a matter of judgment. Non-linear or completely scattered sets may require a least-squares fitted line; however, it could be argued that any data set which truly requires a least-squares line is probably worth redoing. The success of isotherm testing rests with strict attention to procedural detail.

Once a straight line of fair precision has been drawn, it is extrapolated towards the right to the C_o intercept. The resulting ordinate, here 450 mg COD/g carbon, is a measure of adsorption capacity. The slope of the isotherm line may also be used to characterize the adsorption operation being tested. Steeper slopes indicate good adsorption of organics present in solution at higher concentrations but not at lower concentrations. Slight slopes indicate comparable adsorption over the entire range of organic concentrations. Higher slopes generally indicate that greater adsorption efficiency in column operations can be expected.

FIGURE A-13

TYPICAL ADSORPTION ISOTHERM



Column Configuration and Size

Brief mention was made in the introduction of the two principal configurations of the contact columns (see Figures A-10 and A-12). Some other possible configurations are possible, of which the most important is probably the semi-continuous mode in a single or parallel column. The semi-continuous mode of operations is essentially equivalent to the so called "continuous-loop" ion exchangers wherein sections of adsorbent are removed from the waste-in end of the column for regeneration at frequent intervals. At the same time, an equivalent quantity of virgin or regenerated adsorbent is inserted into the column at the product end of the column. In this manner a semi-continuous counter current flow of wastewater and adsorbent is maintained. The advantages include an inventory of adsorbent and assurance that the adsorbent is being loaded to the maximum extent possible which results in reduced regeneration costs.

A disadvantage in this case is a reduced flexibility for automatically handling the wide fluctuations expected in waste concentrations. Also, the relatively low volumes of wastewater expected may reduce the low carbon inventory advantage of semi-continuous mode operation since the minimum number of columnus (including backup) may be the same in both semi-continuous and two-stage operation.

In comparing single column and multiple column operation for a given volume of carbon, the M. W. Kellogg Company in a report to the EPA[A-38] found that for treating secondary sewage at the same total contact time and hydraulic loading that the two stage column operation (see Figure A-12) was more economical than either the single stage operation or when three or more stages were used.

Regeneration of Spent Granular Activated Carbon

The Swindell-Dressler report gives a good description of the regeneration process.[A-37]

> *To make granular activated carbon economically feasible for wastewater treatment, the spent carbon must be regenerated and reused. When a carbon column has been operated for some time, the quality of its product water deteriorates gradually until it passes some predetermined limit beyond which it is no longer acceptable. The carbon must then be regenerated. When the lead contactor (assuming a multi-stage configuration) is taken offstream, the usual practice*

is for the number two contactor to become the new lead contactor. All additional contactors, if any more are used, move up one place in the series. A spare contactor containing virgin and/or regenerated carbon is inserted into the last position in series.

The thermal regeneration of carbon is presently the only feasible procedure for destroying adsorbed organics. Thus maximum effort has been concentrated on optimization of thermal regeneration techniques, using a reducing atmosphere of flue gas and steam.

A typical basic sequence for the thermal regeneration of carbon is as follows:

a. *The granular carbon is hydraulically transported (pumped) in a water slurry to the regeneration station for dewatering.*

b. *After dewatering, the carbon is fed to a furnace (usually of the multi-hearth type) and heated to 1500°F - 1700°F in a controlled atmosphere which volatilizes and oxidizes the adsorbed impurities.*

c. *The hot regenerated carbon is quenched in water.*

d. *The cooled regenerated carbon is again hydraulically transported to the adsorption equipment or to storage.*

The thermal regeneration process itself involves three steps:

a. *Drying*

b. *Baking (pyrolysis of adsorbates), and*

c. *Activating (oxidation of the residue from the adsorbate).*

The regeneration process itself requires 30 minutes: the first 15 minutes is a drying period during which the water retained in the carbon pores is evaporated, a 5-minute period during which the adsorbed material is pyrolyzed and the volatile portions thereof are driven off; and a 10-minute period during which the adsorbed material is oxidized and the granular carbon reactivated.

As a contactor is removed from service for regeneration, the spent carbon is usually hydraulically transported to a drain bin. The drained carbon is dried during the first step in a furnace which heats the carbon up to 212°F (for this phase of the regeneration). During baking, the temperature increases from 212°F to 1500°F, by which time adsorbed organics are thoroughly carbonized. This is accompanied by evolution of gases and by the formation of a carbon residue in the micropores of the activated carbon. The objective of this activating step is to oxidize the carbon residue with minimum resultant damage to the basic pore structure, consequently affecting maximum restoration of the original properties of the carbon. The activating gas temperature during this step is about 1700°F, while the carbon temperatures range from 1500°F to 1650°F. Flue gas supplemented by varying amounts of additional steam produces the desired atmosphere. Laboratory experiments indicate that the most important phase of the regeneration process is that of activation, with the critical parameters being carbon temperature, duration of activation, and steam or carbon dioxide concentration in the activating gas mixture. Since most commercial installations are direct-fired multiple hearth furnaces for regeneration, the combustion of natural gas with air provides the required heat, while carbon dioxide, oxygen and steam, as part of the products of combustion, are the activating agents. Extra steam at approximately one pound per pound of product regenerated is supplied. This requires some steam generating equipment and a boiler feedwater treatment system.

For regeneration processes utilizing multiple hearth furnaces, the overall carbon losses usually vary from 5% to 10% per regeneration cycle. As stated before, the relatively high cost of granular activated carbon (24¢ to 30¢ per pound) makes it economically necessary to regenerate and reuse the carbon. If a 5% loss of carbon per regeneration cycle is assumed, then most of the carbon originally in use will have been replaced after 20 cycles and the bulk or aggregate properties of the mix will have approached a constant value.

Multiple hearth furnaces used for regenerating carbon should consider the BSP recommendation that the hearth area contain one square foot per 100 lbs of carbon to be regenerated per 24 hours. A slight over-

sizing of the furnace beyond this provides for future expansion of a treatment plant at very low cost.

The operating cost of the furnace can be developed by assuming a fuel requirement of 3200 BTU and one pound of steam per pound of carbon. The energy required to generate the steam will be approximately 1250 BTU per pound.

The rate at which the carbon in a single contactor is exhausted determines the minimum rate at which this same carbon must be regenerated (in order that it might be available for use again as a spare contactor). The furnace must be oversized by a factor of two or more so that the design regeneration rate exceeds the exhaustion rate by a safe margin.

The regeneration process may be monitored by reducing the apparent density of the carbon back to its virgin value. Larger apparent densities than the virgin value indicate an incomplete regeneration of the carbon and smaller densities are indicative of burning of the carbon.

Flexibility of Operation

Due to the expected large variations in the wastewater contaminant concentrations and the types of contaminants, the carbon loading will vary. As a result the carbon contacting and regeneration system must be designed with more flexibility than is normally found in specific applications. The usual recommendation made in the literature to account for expected increases in the loading rate (either higher contaminant concentrations or higher wastewater flow rates) is to overdesign the regeneration furnace since this is generally more economical than having extra contact columns and carbon inventory. The recommendation by Swindell-Dressler above that the regeneration furnace be designed to handle twice the expected load should probably be followed. A higher regeneration system overdesign might be justified with widely fluctuating organic concentration. A completely optimum design would require a detailed knowledge of the volumes and concentrations of wastewater expected to be treated by the carbon system. A practical approach would probably involve a regeneration system at least twice the size needed for the expected mean carbon exhaustion rate and contact columns that could handle a reasonable increase in flow rate, concentration, or both from the expected mean until lower concentration/flow rate values resumed. The upper limit of concentration might be determined by the economical breakover point between carbon adsorption and perhaps steam stripping. The upper time limit before breakthrough might be determined by the largest volume of a particular type of waste processed. Since corrosion potential would probably require expensive materials (the carbon itself is rather corrosive), a larger than usual carbon inventory could be more economical in this case. In Figure A-12, if the surge bin and makeup storage units were designed to contain twice the volume of a single contact unit, an exhausted column could be emptied and refilled with regenerated carbon and placed back into service quickly. This would allow treatment of the waste for short periods even though the regeneration rate temporarily ran below the carbon exhaustion rate. It would also reduce the necessity of having extra or oversized contactors. Since activated carbon is rather expensive (24-30¢/lb) an economic tradeoff between idle carbon inventory, contact column capacity and regeneration system capacity should be determined. Upflow vs. downflow configuration is also discussed by Swindell-Dressler.[A-37]

> *Downflow*
>
> *Downflow carbon beds accomplish both adsorption and filtration of wastewater. Plants using this mode of operation will utilize hydraulic loadings of 2 to 10 gpm/sq ft. At the lower flow rate, suspended solids contained in the wastewater are normally collected on the surface of the bed. At higher flow rates, some of the suspended solids may penetrate to some distance into the bed.*
>
> *Provision must be made to periodically backwash downflow beds to relieve the pressure drop associated with the plugging by the suspended solids. Continued operation of a downflow bed for several days without backwash may compact or foul the bed sufficiently to make it more difficult to expand the bed during backwash without the use of an excessive quantity of backwash water, i.e., more than 5% of the product water.*
>
> *In addition, biological growth taking place on the surface of carbon granules tends to clog the bed. Partial removal of these growths and control of their activity can be maintained by periodic backwashing, perhaps more frequently than once per day. Complete removal of the biological organisms cannot be accomplished by backwashing.*
>
> *Assurance that aerobic conditions exist is possible through maintaining dissolved oxygen in the feed and*

in the backwash water. If anaerobic conditions develop, sulfides may be generated in the column and may appear in the effluent.

If the suspended solids concentration in the influent to the carbon beds is sufficiently great, the cost of backwashing must be weighed against the cost of providing a pretreatment step.

Upflow

Carbon beds operating with the wastewater passing upward through the carbon can assume three different modes. At low hydraulic loadings, less than 2 gpm/sq ft, the bed of carbon will remain substantially packed at the bottom of the column. At higher hydraulic loadings, 4-7 gpm/sq ft, the bed will become partially expanded. At much higher rates, the carbon will be lifted and packed against the top of the column. In the event that little or no freeboard is available, the bed will operate as a packed bed at any velocity.

When the upflow carbon column is operated as a packed bed, suspended solids present in the wastewater will be collected on the bottom of the bed. Unless preliminary solids removal processes are employed, backwashing of the solids from the bottom of the bed may pose a considerable problem, so these systems are not recommended.

Operating as a partially expanded bed, the carbon will not act as a filter. Syspended solids will pass into the effluent largely undiminished.

In the "pulsed bed" system, wastewater is passed upflow through the bed. Periodically, a column is briefly removed from service, a portion of the carbon in the bottom of the bed is withdrawn, and a fresh equal charge of carbon is forced into the tope of the bed. As noted previuosly, this concept is ony way of approximating true countercurrent operation.

Gravity and Pressurized Flow

The main advantage of a gravity flow system, which may be operated either downflow or upflow, is the elimination of large pumps and their associated operating costs, and the reduction of costs for non-

pressurized vessels. However, due to the limited available head, it is usually necessary to remove suspended solids by pretreatment (e.g. through chemical clarification or filtration) so that headloss and thus backwash requirements are not excessive. Operating a gravity flow system upflow as a partially expanded bed (rather than packed bed) is more attractive in that the pressure drop across the bed will remain constant. Thus this system can provide sustained operation over considerable periods of time. A supplementary solids removal step still may be necessary as either pre- or post-treatment.

Pressurized flow offers the advantages of being able to operate a carbon bed at a higher flow rate and over a greater range of pressure build up before backwashing is necessary. This permits the height of carbon contacting vessels to be limited to the carbon bed depth plus 50% for expansion during backwash.

In summary, the pressurized flow, at additional operating and investment costs, offers guaranteed flexibility in overcoming increasing pressure drops through packed beds. On the other hand, the gravity flow systems, although not fully evaluated at this time, offer considerable cost savings.

Normal Operating Conditions

Pressure depends upon upflow or downflow configuration and upon the suspended solids content of the wastes. Temperature will be near ambient. The pH normally would be near neutral as a result of the previous neutralization step. However, reduction of the pH to about three may be required at times to control anaerobic production of H_2S. The corrosion resistance of materials used for chemicals such as phenol (SS 304) would be sufficient to resist attack by pH 3 solution.

Process Economics

The major capital expenditures for a carbon adsorption system of this type would be for the regeneration system. Since the expected mean contaminant concentrations will be near 1,000 ppm, the relative size of the regeneration system compared to the regeneration system for treating municipal waste would be higher and thus the costs would be greater. A rough cost estimate for 1,000 ppm phenol and 60,000 gallons per day flow rate shows that a regeneration furnace overdesigned by a factor of two represents over 45 percent of the total capital costs of a carbon adsorption plant. This estimate was made using 304 stainless steel. If three carbon contact columns of 304 stainless steel were used, they would represent about 30 percent of the total capital investment. The piping pumps, valves and initial carbon inventory represent the remaining 25 percent of the total capital cost. This is in sharp contrast to the capital cost breakdown reported by Swindell-Dressler in the EPA Design Manual. The design manual results appear to be primarily based upon treating relatively low level secondary municipal effluents. The high percentage of the total capital costs represented by the regeneration system is confirmed by costs data of a carbon adsorption plant designed to treat 150,000 gpd of a wastewater from a herbicide manufacturing plant containing over 200 ppm of various phenols and cresols and 1,000 ppm of various alcohols. The percentage of the total capital cost for the regeneration system was nearly 50 percent for that operation.[A-39]

Based upon 60,000 gpd of 1,000 ppm phenol and using SS 304 throughout, the cost breakdown was approximately as follows:

Three columns	$157,000
Valves	40,000
Pumps	25,000
*Thermal Regeneration System which includes the following:	250,000
Dewatering Tanks	
Surge Bin	
Screw Feeder	
Valve	
Furnace	
Quench Tank	
Diaphragm Pump	
Controls	
Carbon Feed Tank SS 304	30,000
Initial Carbon Inventory	8,600
Pipe	10,000
	$520,600

---

*This does not include about $60,000 for the after burner and stack scrubber. Location of furnace near incinerator would eliminate duplication.

Using a 20 year useful life and five percent interest, the operating costs* would be:

Depreciation	0.134¢/gal
Interest	0.134¢/gal
Carbon Makeup	0.073¢/gal
Labor(112 men,24 hours per day,$5 per hour	0.100¢/gal
Utilities (estimated)	0.050¢/gal
Maintenance	0.040¢/gal
	0.530¢/gal

The cost for 60,000 gpd at 2,000 ppm phenol would be the same since the regeneration system was overdesigned by a factor of two. Some significant savings could be achieved if coatings or other materials of construction could be used in place of the stainless steel. Henshaw[A-39] reported using wooden contact columns for the herbicide manufacturing plant effluent. Based upon this data, consideration might be given to reducing the overdesign of the regeneration system in favor of a larger carbon inventory to treat temporary increases in flow and/or contaminant concentration. Phenol was used as a design contaminant because the isotherm slope was low and the ultimate carbon loading was low. Many other chemicals would have a much higher loading rate. Also, phenol is one of the most important hazardous materials based upon a combination of volume produced and toxicity.

Process Modifications

Possible modifications include the semi-continuous or pulsed column operation described in Process Design. Another potential modification involves the use of powdered activated carbon in place of the granular carbon. The powdered carbon because of its smaller grain size has a higher specific surface area which increases both the rate of loading as well as the ultimate loading capacity. Perhaps more importantly, the powdered carbon in slurry form could be contacted with the waste in a batch, counter-current or co-current reactor. This would allow a great deal of flexibility in operation as well as reduce the capital costs of the contacting process. Unfortunately however the carbon must still be regenerated, which means recovery by filtration, precipitation, or other means. Although recent attempts to regenerate powdered activated carbon show some promise[A-41,A-42] the technique and equipment have not yet received widespread acceptance. For low flow rates or low concentrations, powdered carbon may be used and incinerated on a once-through basis since its cost is about one-third the cost of the granular product (10¢/lb).

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*All costs given in cents per thousand gallons.

Process Applicability

Carbon adsorption can remove most types of organic wastes from water. Short carbon chain polar substances such as methanol, formic acid, and perhaps acetone are incompletely removed. The removal of inorganic substances is treated in Process Design.

Several carbon adsorption plants are in successful full-scale operation for tertiary treatment of municipal wastes. Perhaps the prime example is the plant at South Lake Tahoe, California, which includes seven carbon contactors operating upflow in parallel. Figure A-14 is an illustration of a section through a contactor. The design provides for the semi-continuous or "pulsed" carbon removal and replacement. Figure A-15 is a flow diagram of the regeneration system.

A typical analysis of the efficiency of the process is given in Table A-72.

The carbon adsorption unit treating herbicide plant wastes mentioned under Process Economics is operated by the Chipman Division of Rodia Corporation.[A-39] Table A-73 is an analysis of the waste treated by that unit.

The effluent standard which has been successfully met is 1 mg/l phenol.

Figure A-16 is a flow diagram of the Chipman adsorption unit.

Full scale carbon adsorption units have also been successfully used for petroleum and petrochemical wastes.[A-34] flow diagrams generally are minor variations of the ones previously shown.

AMMONIA STRIPPING PROCESS DESCRIPTORS

Ammonia can be readily removed from alkaline aqueous wastes by stripping with steam at atmospheric pressure. The waste stream, at or near its boiling point, is introduced at the top of a packed or bubble cap tray type column and contacted countercurrently with steam. Due to its high partial pressure over alkaline solutions, ammonia is removed from the waste and concentrated in the vapor phase. The concentrated ammonia is condensed and reclaimed for sale, and liquid effluents from a properly designed steam stripping column will be essentially ammonia free.

FIGURE A-14

SOUTH LAKE TAHOE UNIT
SECTION THROUGH CARBON COLUMN

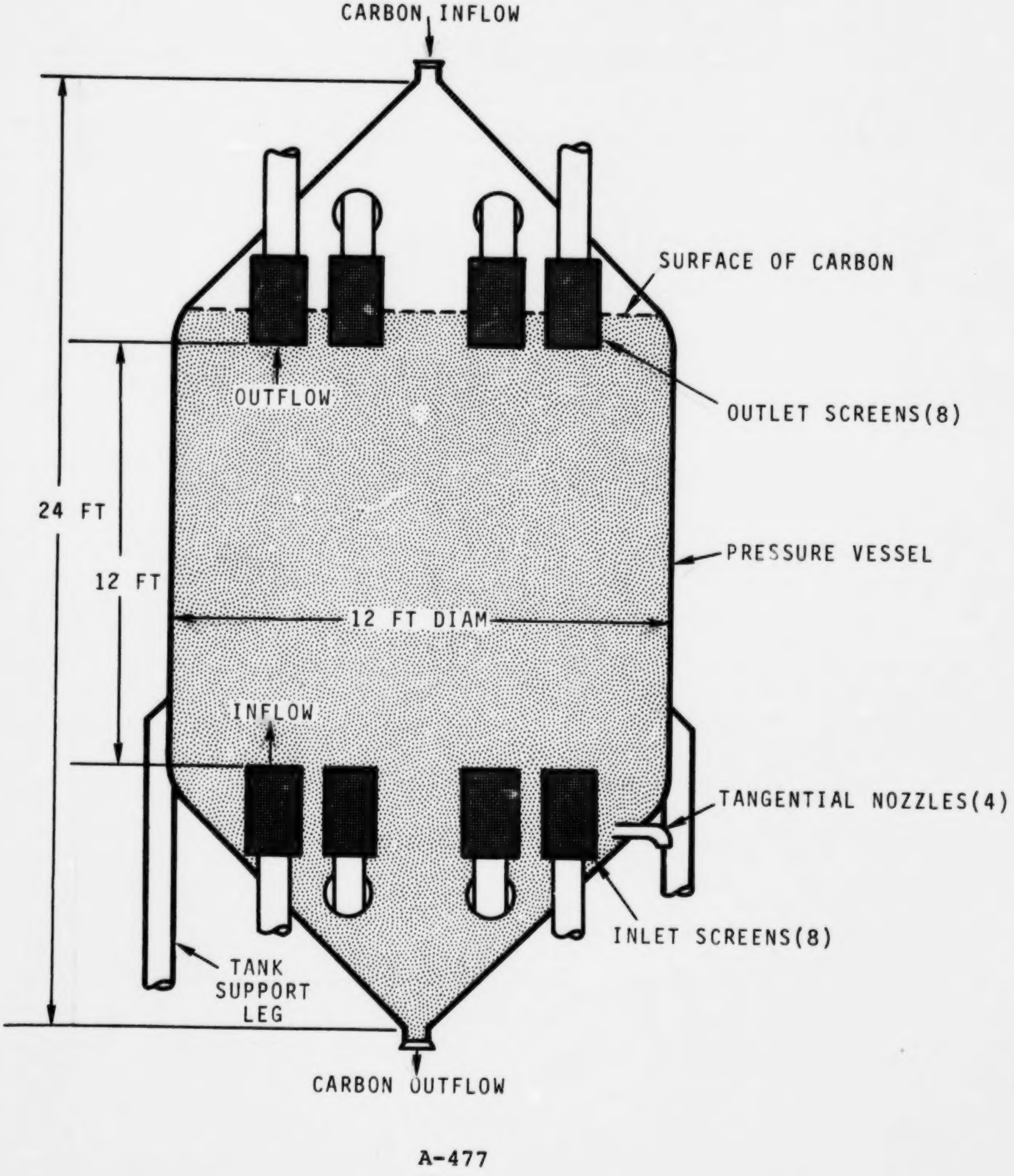
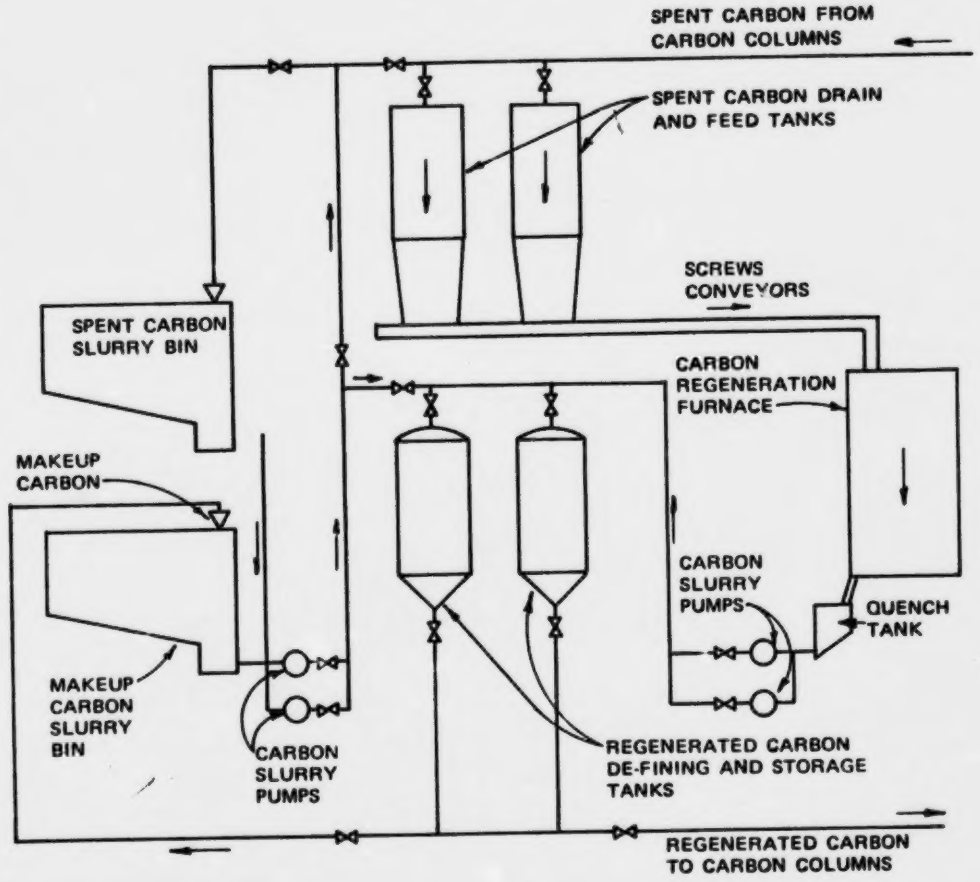

CARBON INFLOW
SURFACE OF CARBON
OUTFLOW
OUTLET SCREENS(8)
24 FT
PRESSURE VESSEL
12 FT
12 FT DIAM
INFLOW
TANGENTIAL NOZZLES(4)
INLET SCREENS(8)
TANK SUPPORT LEG
CARBON OUTFLOW

FIGURE A-15

STPUD
CARBON REGENERATION SYSTEM[A-33]


SPENT CARBON FROM CARBON COLUMNS
SPENT CARBON DRAIN AND FEED TANKS
SCREWS CONVEYORS
SPENT CARBON SLURRY BIN
CARBON REGENERATION FURNACE
MAKEUP CARBON
CARBON SLURRY PUMPS
QUENCH TANK
MAKEUP CARBON SLURRY BIN
CARBON SLURRY PUMPS
REGENERATED CARBON DE-FINING AND STORAGE TANKS
REGENERATED CARBON TO CARBON COLUMNS

A-33

TABLE A-72^{A-33}

SOUTH LAKE TAHOE
A COMPARISON OF COD AND MBAS REMOVAL EFFICIENCY BETWEEN FIRST CYCLE CC-5 AND THIRD CYCLE CC-6

Carbon Column	CC-5	CC-6
Regeneration Period	11/15/68 to 10/5/69	
Regeneration Cycle	First	Third
Total Flow in Period	202.2	189.3
Total Pounds of Carbon Regenerated in Period	40960	41100
Carbon Dosage $\frac{\text{lbs reg.}}{\text{MG}}$	202	217
Chemical Ozygen Demand		
Influent gm/l	18.2	18.2
Effluent mg/l	9.5	8.0
Percent Removal	47.8	55.0
lbs In	30720	28693
lbs Removed	14695	16084
lbs In/lb Carbon Reg.	.75	.70
lbs Removed/lb Carbon Reg.	.36	.39
Methylene Blue Active Substances		
Influent mg/l	.55	.55
Effluent mg/l	.13	.13
Percent Removal	76.4	76.4
lbs In	927	869
lbs Removed	708	663
lbs In/lb Carbon Reg.	.023	.021
lbs Removed/lb Carbon Reg.	.017	.016

A-73

TABLE A-73[A-33]

CHIPMAN HERBICIDE PLANT ANALYSIS OF WASTEWATER*

Component	Concentration (mg/l)
Phenol and Cresol	10
Chlorophenols and Chlorocresols	100
Chlorophenoxyacetic Acids	100
Alcohols (Primarily Octyl)	1,000
Chlorides (as NaCl)	50,000
Sulfates (as Na_2SO_4)	8,000
Biochemical Oxygen Demand (BOD)	2,000
Chemical Oxygen Demand (COD)	3,600
Total Solids	62,000
Suspended Solids	10

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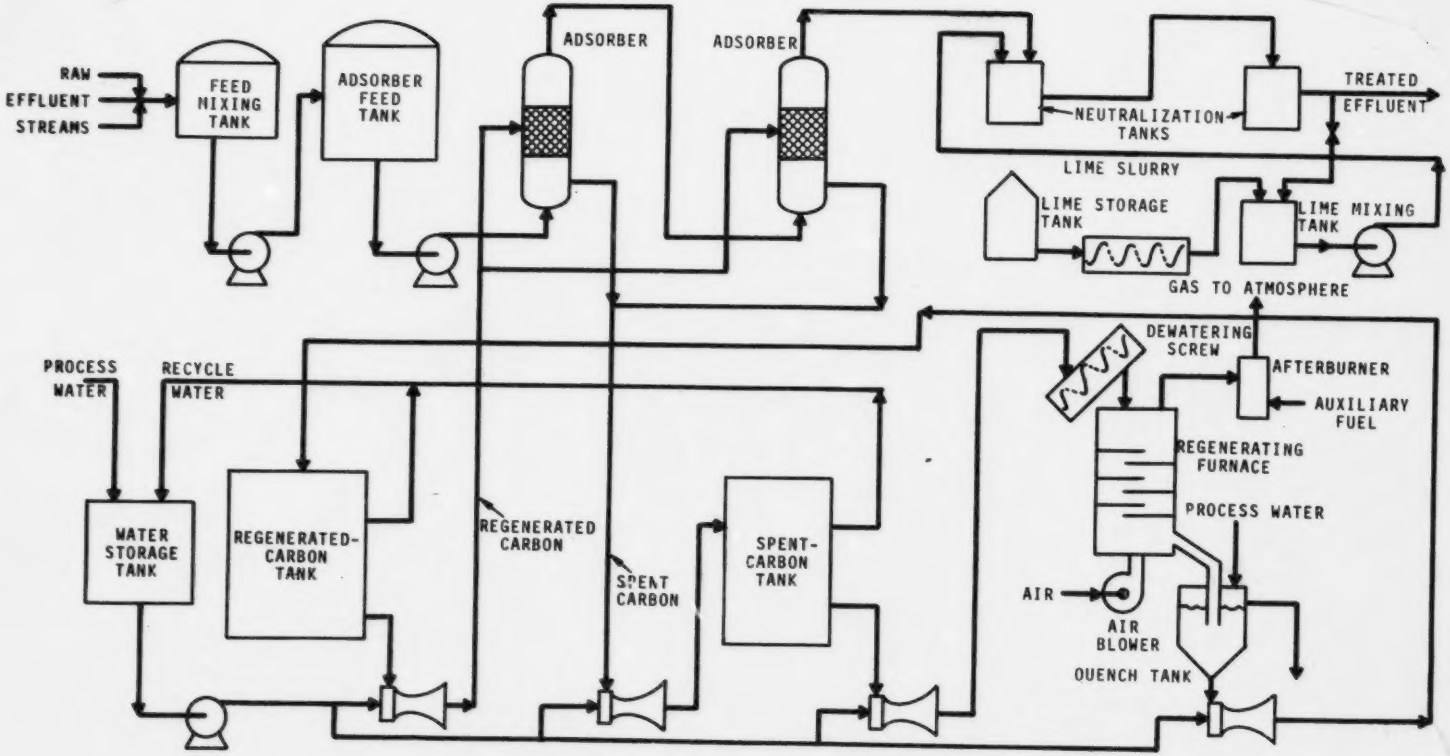
*pH 0.5

FIGURE A-16

CHIPMAN HERBICIDE CARBON ADSORPTION UNIT^{A-39} FLOW DIAGRAM


RAW
EFFLUENT
STREAMS
FEED MIXING TANK
ADSORBER FEED TANK
ADSORBER
ADSORBER
NEUTRALIZATION TANKS
TREATED EFFLUENT
LIME SLURRY
LIME STORAGE TANK
LIME MIXING TANK
GAS TO ATMOSPHERE
DEWATERING SCREW
AFTERBURNER
AUXILIARY FUEL
REGENERATING FURNACE
PROCESS WATER
AIR
AIR BLOWER
QUENCH TANK
PROCESS WATER
RECYCLE WATER
WATER STORAGE TANK
REGENERATED-CARBON TANK
REGENERATED CARBON
SPENT CARBON
SPENT-CARBON TANK

Operating Principle

The removal of ammonium ions and dissolved ammonia from aqueous solutions by stripping is controlled by 1) the equilibrium between the ammonia and ammonium ions in the liquid phase and 2) by the partial pressure of ammonia gas over the solution. The equations governing 1 above are:

$$NH_4 + {+OH^-} = NH_3 + H_2O$$

$$K_{NH_3} = \frac{\left[NH_4^+\right]\left[OH^-\right]}{\left[NH_3\right]} = 1.8 \times 10^{-5} \text{ at } 25°C$$ [A-43]

$$H_2O = H^+ + OH^-$$

$$Kw = \left[H^+\right]\left[OH^-\right] = 10^{-14} \text{ at } 25°C$$

$$\left[OH^-\right] = \left[OH^+\right] = 10^{-7} \text{ at neutrality}$$

$$\text{Therefore } \frac{\left[NH_3\right]}{\left[NH_4\right]} = 5.5 \times 10^{-3} \text{ at } 25°C$$

It is apparent from the above equations that the waste solution must be stripped on the alkaline side or at least at neutral pH. As ammonia is removed from solution the pH will fall. Therefore, depending on the total ammonia concentration, the waste must have a high initial alkalinity or have buffering capacity (e.g., carbonate-bicarbonate or phosphate systems).

For dilute ammonia solutions the vapor liquid equilibria is described by Henry's Law:

$Y = MX$

where Y = mole fraction NH_3 in the vapor

X = mole fraction NH_3 in the liquid

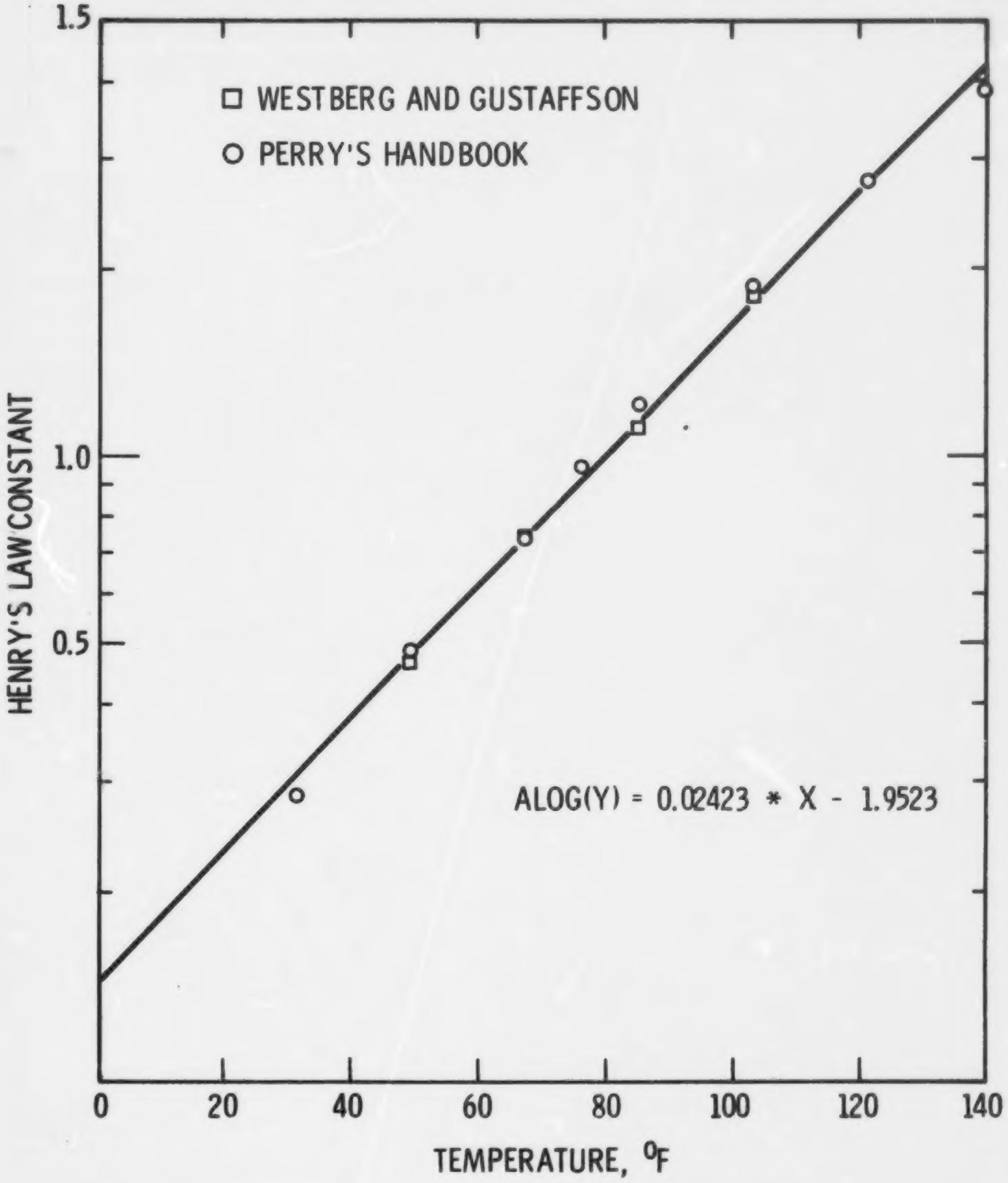
M = Henry's constant, a function of temperature, shown in Figure A-17.[A-44]

By extrapolation of Figure A-17, M is found to be 20 at 212°F, the conditions of saturated steam stripping.

The ammonia-rich vapor exiting from the top of the stripping tower would be condensed to an aqueous ammonia liquid solution. The partial pressure ammonia in an aqueous ammonia solution at ambient temperature and pressure is such that the maximum concentration would be about 30 percent ammonia. In order to

FIGURE A-17

HENRY'S LAW CONSTANT AS
A FUNCTION OF TEMPERATURE



assure a uniform ammonia concentration in the product provision should be made for a "reflux" stream from the vapor condensor. In the case of a liquid feed which is rather low in ammoniacal nitrogen, a lower vapor flow rate (V) to liquid flow rate (L) ratio, V/L, would be required to maintain a constant overhead concentration. At the same time a larger contact depth would be necessary to effect the desired separation. These problems can be minimized by refluxing part of the condensed ammonia stream. The ratio V/L within the column can be maintained above a predetermined minimum. Reflux has the disadvantage of increasing steam requirements.

Process Applicability

This discussion has been directed toward treatment of ammonia bearing wastes. Much of the equipment and the same general process could be used, however, to remove various volatile and organic contaminants. In place of condensing the overhead (any reflux would require condensation), the vapor would be routed to the incinerator for combustion. Application of the stripper for organic contaminant removal would require that the Henry's Law constant for the specific system involved, contaminant and water, must be larger than unity at 212°F and ambient pressure. The larger Henry's constant the better the potential separation and process economics. Since the optimum feed point along the length of the column is determined by Henry's constant and the reflux ratio, using a column designed for ammonia removal may result in less than the optimum system for organic removal. Introduction of several possible feed points into the stripping column would provide flexibility.

Process Economics

The major factors which determine the economics of an ammonia steam stripping operation are: 1) expected waste liquid flow to be treated, 2) expected range of ammoniacal nitrogen concentration, and 3) maximum allowable ammoniacal nitrogen in the tower bottoms. The diameter of the tower, size of process lines, pumps, tanks, and other units are a direct function of the waste liquid flow rate. The steam flow rate and consequently the condenser size and cooling water flow to the condenser are also direct functions of the liquid flow rate. The height of the tower and reflux ratios are direct functions of the difference between the influent nitrogen concentration and the bottoms nitrogen concentration. Since the steam demand and condenser duty are dependent upon the reflux ratio, they are also functions of difference between input and bottoms ammonia concentration. The local market for 30 percent ammonia nitrogen will also affect the economics. If the product is salable, part of the costs of removing ammonia from the waste would be returned. If the 30 percent ammonia has to be shipped to a market or given away, the net cost of ammonia removal is increased.

Some of the energy costs could be reduced by installing a heat exchanger between the feed and tower bottom steam to preheat the feed, but since this would increase capital and maintenance costs, it would not be justified for feed flow rates below a particular value.

Example 1: Coke Production[A-46, A-47]

In producing coke, the volatile components of coal are driven off in ovens, then treated with a water wash. Among the volatile components thus separated from coal into an aqueous solution are ammonia, phenols, and cyanides. This solution is sent to an ammonia still such as the one shown in Figure A-18. The approximate composition of this solution before and after stripping is shown in Table A-74. Because of the high ammoniacal nitrogen concentration, lime is introduced to drive the reaction equilibrium to ammonia gas. The lime addition results in the "lime leg" and "fixed leg". The dissolved NH_3 is removed in the free still area above the lime leg and the NH_4^+ is converted to NH_3 in the lime leg. The high pH solution at the bottom of the lime leg overflows into the fixed leg where the remaining NH_3 is stripped. An important factor is the low removal of cyanides and phenols, due to the lower vapor pressures for these components brought about by the high pH of the solution.

Example 2: Ammonia Removal from Low Level Radioactive Wastes

Ammonia and organic removal prior to ion exchange treatment of radioactive wastes was successfully performed on a small scale at Hanford, Washington. Organic removal avoided "fouling" of the ion exchange resins, whereas ammonium ion removal greatly reduced the competition for sites on the cation resin and allowed a much higher loading of the radioactive cations before breakthrough. Figure A-19 is a flow diagram of the total system and Table A-75 summarizes the performance of the steam stripper. The boil-off rate, or fraction of bottoms converted to steam, was 15 percent.

FIGURE A-18

DIAGRAM OF AN AMMONIA STILL

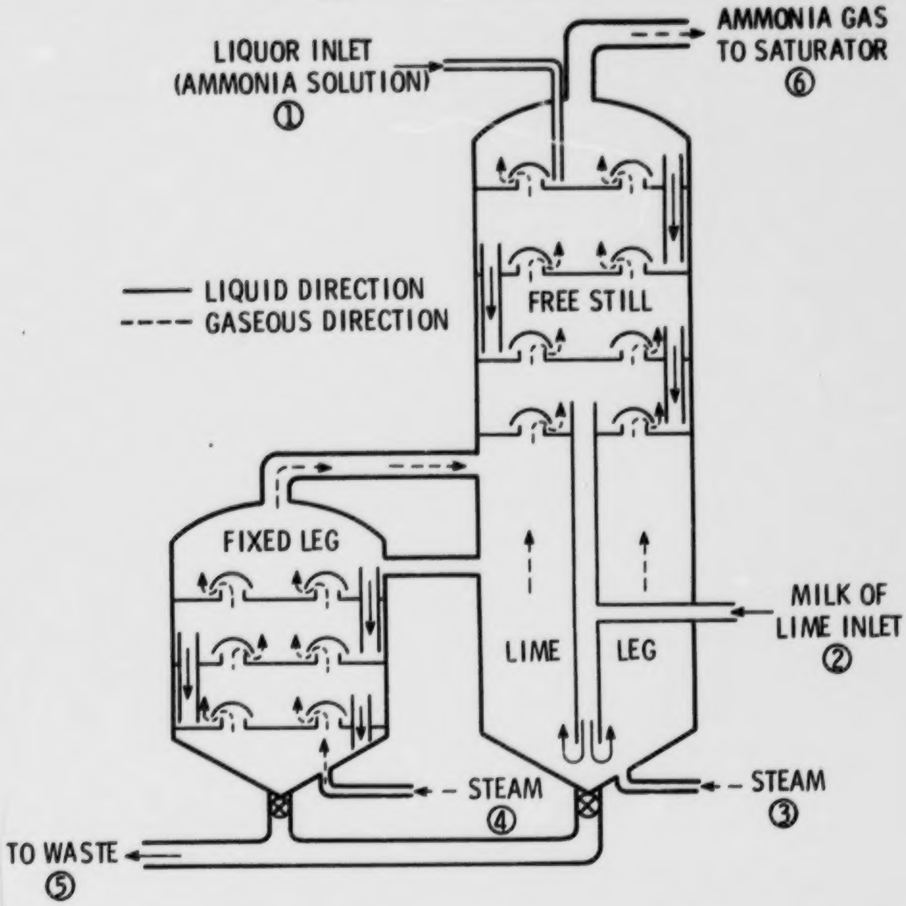

LIQUOR INLET
(AMMONIA SOLUTION)
①
AMMONIA GAS
TO SATURATOR
⑥
LIQUID DIRECTION
GASEOUS DIRECTION
FREE STILL
FIXED LEG
MILK OF
LIME INLET
②
LIME
LEG
STEAM
④
STEAM
③
TO WASTE
⑤

FIGURE A-19

PILOT PLANT FLOW DIAGRAM
FOR CONDENSATE WASTE TREATMENT

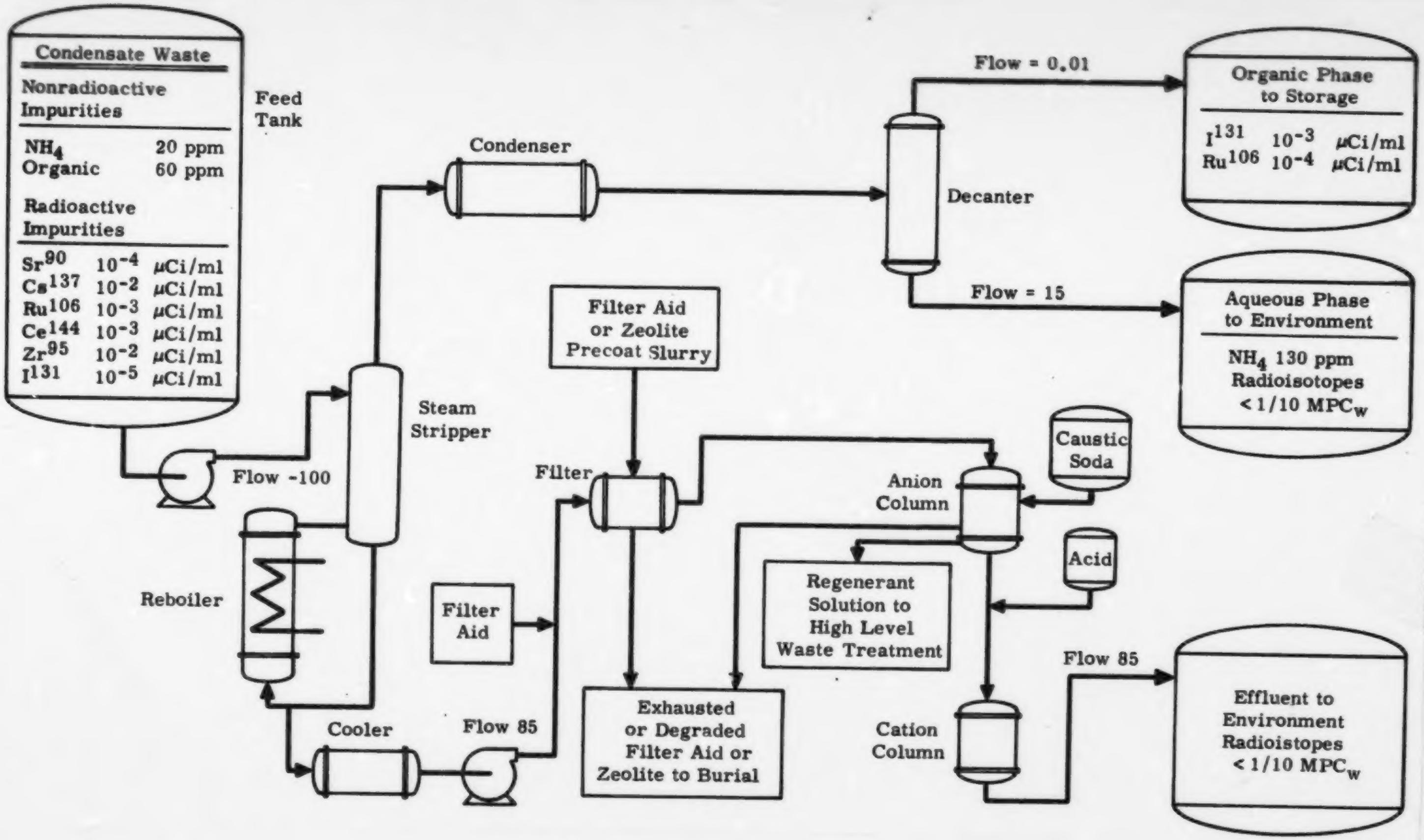

Condensate Waste
Nonradioactive Impurities
NH$_4$ 20 ppm
Organic 60 ppm
Radioactive Impurities
Sr^{90} 10^{-4} µCi/ml
Cs^{137} 10^{-2} µCi/ml
Ru^{106} 10^{-3} µCi/ml
Ce^{144} 10^{-3} µCi/ml
Zr^{95} 10^{-2} µCi/ml
I^{131} 10^{-5} µCi/ml
Feed Tank
Flow -100
Reboiler
Steam Stripper
Condenser
Decanter
Flow = 0.01
Organic Phase to Storage
I^{131} 10^{-3} µCi/ml
Ru^{106} 10^{-4} µCi/ml
Flow = 15
Aqueous Phase to Environment
NH$_4$ 130 ppm
Radioisotopes
< 1/10 MPC$_w$
Filter Aid or Zeolite Precoat Slurry
Filter
Filter Aid
Cooler
Flow 85
Exhausted or Degraded Filter Aid or Zeolite to Burial
Anion Column
Caustic Soda
Acid
Regenerant Solution to High Level Waste Treatment
Cation Column
Flow 85
Effluent to Environment
Radioistopes
< 1/10 MPC$_w$

TABLE A-74[A-48]

APPROXIMATE COMPOSITION OF CRUDE LIQUORS TO AND FROM THE AMMONIA STILL

Liquor	To Ammonia Still	From Ammonia Still, in plant having no dephenolizer
Total ammonia	7000	0.04- 2.5
Free ammonia	4000	0 - 0.04
Fixed ammonia	3000	0 - 2.5
Cyanide, as HCN	20- 100	10 - 100
Chloride	1100-6000	1100 -5000
Sulfate	150-1000	150 -1000
Phenols	400-3000	400 -2500
pH	-	9 - 12.5
BOD	-	2000 -4000

Results expressed as mg/liter, except pH.

TABLE A-75[A-49]

CONCENTRATIONS OF TRIBUTYL PHOSPHATE, HYDROCARBON DILUENT, AND AMMONIA IN FEED AND STRIPPER BOTTOMS

	Concentration, mg/liter	
	Feed	Stripper Bottoms
Tributyl Phosphate	24-65	0.5 - 1.2
Hydrocarbon Diluent	5-23	1.0 - 2.2
Ammonia	16-22	0.1 - 0.8

APPENDIX L

TRANSPORTATION OF WASTES FOR PROCESSING AND DISPOSAL

In some instances volume reduction will be necessary before wastes are shipped from a generation site. Solids content will be increased to the maximum extent consistent with a trade-off of volume reduction costs with transportation costs. Into this volume reduction-transportation balance must be factored safety considerations for handling and shipping the wastes, the expected frequency of spills, and the projected costs for spill cleanup. The complete transportation system is depicted by Figure A-20.

WASTE CLASSIFICATION

The waste streams may be classified into four types according to the general physical characteristics which determine the waste stream's handling and transportation requirements:

- Liquid
- Slurry/sludge
- Mud
- Solids
    1. Free-flowing (granular)
    2. Irregular bulk wastes

The solids contents for the first four classifications are approximately as follows: liquids, 0-3 percent; slurry/sludge, 10-40 percent; mud, 60-90 percent; and solids, 100 percent.

STORAGE METHODS

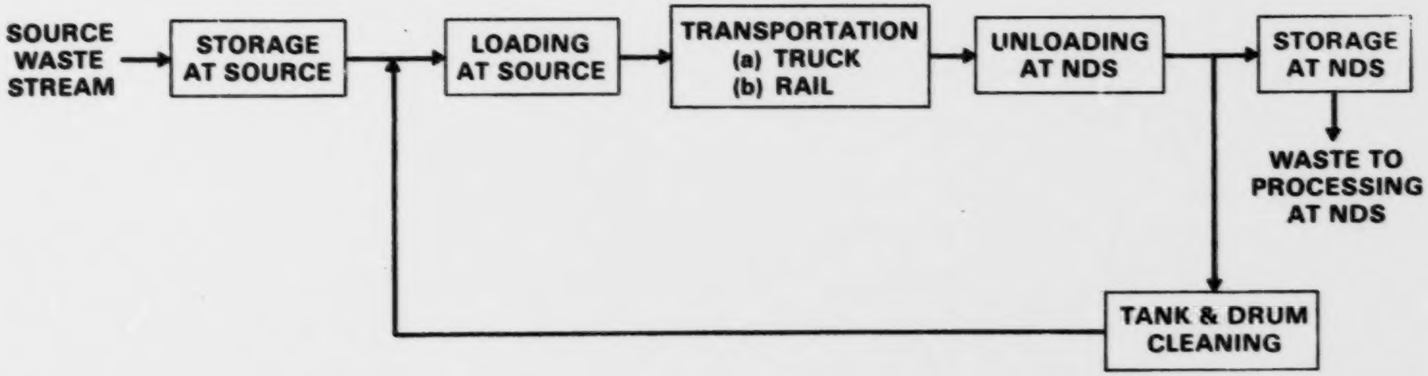
Anticipated modes of waste storage at the waste generation source and/or the processing facility include:

- Lagoons
- Pits (open or closed)
- Barrels (drums)

FIGURE A-20

TRANSPORTATION OF WASTES TO

NATIONAL DISPOSAL SITE


SOURCE WASTE STREAM
STORAGE AT SOURCE
LOADING AT SOURCE
TRANSPORTATION
(a) TRUCK
(b) RAIL
UNLOADING AT NDS
STORAGE AT NDS
WASTE TO PROCESSING AT NDS
TANK & DRUM CLEANING

- Tanks
  1. Stationary
  2. Motor vehicle exchange
  3. Rail car exchange
- Solid waste containers
  1. Motor vehicle exchange
  2. Rail hopper car exchange

The precise storage facilities at either the waste generation sources or the processing facility will depend on the quantity and characteristics of the wastes to be stored.

STORAGE FACILITY COSTS

Lagoon

Liquid wastes may be stored in a lagoon lined with 0.030-mil polyethylene covered with about a foot of soil or clay. Wastes could be transferred to the lagoon directly from freight tank cars. Suitable lined lagoons of one acre and 3-1/2 to 4 feet deep cost approximately $10,000.[A-50]

Stationary Tanks

Liquid wastes and slurried wastes may be stored in stainless tanks. Costs of stainless steel tanks with agitators are given in Table A-76.

Corrosive liquid wastes may require nonmetallic tanks, typical costs of which are given in Tables A-77 and A-78.

Drums

The cost of drums for storage and shipment of wet or dry wastes is shown in Table A-79.

A flatbed truck of semi-trailer design with sides, which may be used for layover storage of drums, costs approximately $6,500.[A-51]

DEMURRAGE CHARGES FOR RAIL FREIGHT CARS

Tank cars or gondola cars loaded with 55 gallon drums may be used as storage containers. Demurrage charges are typically as shown in Table A-80.

TABLE A-76

COST OF STAINLESS STEEL STORAGE TANKS[A-52]

Capacity, Gallons	Cost, Dollars
1,000	7,300
5,000	12,000
10,000	24,000
20,000	32,000

TABLE A-77

COST OF POLYETHYLENE TANKS[A-52]

Capacity, Gallons (Flat bottom, no agitation)	Cost, Dollars
1,000	626
3,000	806
5,200	1,350

TABLE A-78

COST OF FIBERGLASS-REINFORCED PLASTIC TANKS[A-52]

Capacity, Gallons	Cost, Dollars
1,010	959
3,110	1,792
5,000	2,456
10,355	3,318
20,100	5,202
30,215	7,092

TABLE A-79

COST OF SHIPPING DRUMS[A-53]

Type	Unit cost, Dollars
New polyethylene-lined drums (55-gal, snap-on ring sealed)	33.00
Used polyethylene-lined drums	15.00
Unlined drums	9.75
Rubber lined drums	90.00(11)

TABLE A-80

DEMURRAGE COSTS FOR RAIL CARS

Time on Site	Fee, Dollars per Day
First 2 days (after 7 a.m.)	0
Next 4 days	10
Next 2 days	20
Additional days	30

Note: There is no charge for Saturday and Sunday if car is on site for less than three days. There are no charges if cars are leased. The same fees would be applicable to a hopper car for dry wastes.

TABLE A-81

COSTS OF SEMI-TRAILER TANKS[A-54]

Material	316 SS	304 SS	Carbon Steel
Cost of unit, dollars	15,732	13,090	8,225
Federal tax, dollars	1,122	1,100	617
Total cost, dollars*	16,864	14,100	8,842

* Sales tax additional.

Motor Vehicle Units (Liquid)

Motor vehicle exchange tanks may be used for temporary storage. Costs for 5,000 gallon units are shown in Table A-81.

Motor Vehicle Units (Dry Solids)

Dry irregular solid wastes will be delivered in containers and stored in sheltered storage areas. The containers will be used as temporary storage units. Typical equipment costs are shown in Table A-82.

A wide range of compacting units are available, from household size to large paper balers. Cost of one compactor which may be used for solid waste handling is as follows:

25 HP - (bales formed are 48 inches by 48 inches by 30 inches) $8,250[A-55]

LOADING AND UNLOADING OF WASTES

Methods

Choice of loading and unloading method(s) at either the source or the primary facility will depend upon the type of wastes being handled. A representative list of loading/unloading alternatives could include:

- gravity flow (for liquids and light slurries);
- pump (centrifugal for liquids and sludges/slurries);
- fork lift (with drum handling and front loader attachment);
- screw, bucket, or belt conveyors (for mud only);
- tank, flatbed, or containerized tailgate dump motor vehicle exchange;
- tank, drum loaded gondola car, or hopper rail car exchange; and
- gas cylinder hand truck.

The loading and unloading method used will depend on the quantities and characteristics of the wastes, whether wet or dry.

Gravity feed will be used for transferring liquids and light slurries from stationary holding tanks to mobile tanks or drums

TABLE A-82

COSTS FOR SHIPPING UNITS AND STORAGE FACILITY FOR DRY SOLID WASTES

Unit	Cost, Dollars
Semitrailer tail end dump truck (38 feet long - 50 cubic yards capacity)	12,000[A-56]
Containers with bottom discharge doors (300 cubic feet capacity - crane required for discharge)	1,200[A-56]

Additional equipment which might be used by the generator facility is listed below:

	Size of Unit	Cost, Dollars[A-57]
Solid waste compactor (for use with containers below)	(15 hp unit)	11,175
	(30 hp unit)	12,970

	Capacity, Cubic Yards	Cost, Dollars[A-57]
Containers for above units	6	640
	8	740
	10	1,230
	20 1/2	3,635
	22	3,740

over short distances. Fast transfers can be made by this method with a minimum of layover time for the receiver.

Pumps may replace the gravity feed when necessary with the same benefits of fast transfer. When small and variable quantities of liquids, slurries/sludges, or mud are generated over a lengthy period, the wastes may be stored in a drum and loaded onto the receiver as required.

Conveyors will be used only for muds, salt crystals, or grain-like solid wastes. The conveyor selected will depend on the type of solids and the length of the run.

Motor vehicle exchanges are a common practice where semi-trailers are left at the site for loading or unloading. This type of operation may be used where docking space and storage space are available and convenience is desired. This system is universally practiced for shipment of irregularly shaped dry solid wastes.

Rail car exchange is comparable to motor vehicle exchange except that demurrage charges are involved and large regular volumes would be shipped.

Costs

Gravity flow is the simplest way to move liquids or slurries. No costs are involved in these studies since the liquids are brought to sufficient height for gravity flow by the generating unit.

Pumps vary in cost according to height of head and capacity. Several stainless steel pump costs are listed in Table A-83.

A heavy duty fork lift truck with electric drive, battery charger, and barrel handling attachment costs about $12,000. This unit would load, unload, and tip the barrel to empty contents. The cost of a similar unit with front loading bucket for solid waste handling would be about the same.

Conveyors would be used to transport muds from thickeners or lagoons. Typical conveyor costs are shown in Table A-84.

TRANSPORTATION OF WASTES

Containers for Transportation

The types of containers to be considered for waste transportation include the following:

TABLE A-83

COSTS OF STAINLESS STEEL CENTRIFUGAL PUMPS[A-58]

Capacity, Gallons per Minute	Head, Feet	HP	Cost, Dollars
30	30	1/2	635
50	30	3/4	687
100	30	1 1/2	1,035
200	30	5	1,170
400	30	7 1/2	1,860
500	30	7 1/2	2,040

TABLE A-84

CONVEYORS FOR HANDLING MUDS

Type of Conveyor	Capacity Tons per Hour	Installed Cost Dollars*
Screw [A-59]	55 (sand)	2,400
Belt[A-60]	50 (100 pounds per cubic foot of material	2,755
Bucket[A-61]	14 (100 pounds per cubic foot of material	2,940

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*For 30 foot length

- barrels (drums);
- motor vehicle and rail car exchange tanks; and
- open body unit motor vehicle tail dump and rail hopper cars.

Construction materials for the containers will be dictated primarily by the corrosiveness of the wastes to be transported. Specifying the use of one material will eliminate the need for segregation of containers, thereby reducing the chance of accidents. Corrosive wastes included as candidates for disposal at a centralized facility are mineral acids and inorganic salts. Reinforced fiberglass or polyethylene, either as the primary construction material or as a liner, are the recommended container materials for all types of inorganic and organic wastes except those containing hydrofluoric acid. For these, containers lined with epoxy, phenolic resin, or butyl rubber are recommended.

Polyethylene-lined 55 gallon snap-on ring-sealed steel drums will be used for all classes of wastes, wet or dry. The lined drums will give the strength and corrosion resistance required for most wastes. The containers will be used exclusively for transporting toxic wastes and will be identified with a specially designed label so that they will not be misused.

Tanks will be used for liquids and light slurries. The motor vehicle tank will be a one compartment unit with a capacity of 5,000 gallons. It will have a hot rolled steel or stainless steel body, depending on the corrosive properties of the waste shipment.

The rail tank cars, which will be one compartment units with 10,000 to 15,000 gallons capacity, will be available in a variety of tank materials. The tanks may be interior lined, nickel clad, or stainless steel clad and insulated and heated. Such tank cars can be leased or rented from railroads.

The tail dump motor vehicle would be a containerized unit which could be picked up by the transporter. These units would be constructed of hot rolled steel. The rail counterpart of the tail dump truck would be a sealed and bottom dumped hopper car. This unit would be constructed of hot rolled steel and would handle dry solid wastes.

Transportation Modes

The two principal methods of transporting wastes to the storage/disposal site will be: motor vehicles, both flatbed (for drums of wastes) and tank; and rail cars, both flatbed (gondola cars) and tank.

The mode of transportation used will be dictated by availability, flexibility for waste collection, safety requirements, and waste quantity to be transported.

A substantial amount of wastes will be shipped via flatbed motor vehicle in lined 55-gallon drums. This mode of transportation is relatively safe. In the case of an accident, smaller quantities would need recovery after spillage. Five hundred gallons of wastes may be shipped in a standard load, but loads as high as 700 gallons could be shipped on special vehicles.

Rail cars will be used for exceptionally large loads.

Size of Transporters

The unit size of transporters will be determined by the quantities of wastes regularly collected in each trip. Typical waste quantity volume ranges to be considered for sizing a transporter unit might be up to 5,000 gallons, 5,000 to 10,000 gallons, and 10,000 to 15,000 gallons.

A motor vehicle can transport 50,000 pounds, or approximately one hundred 55-gallon drums. Compartments of tank freight cars or individually lashed down tanks can hold 5,000 to 10,000 gallons. A standard tank freight car can hold 10,000 to 15,000 gallons.

A substantial portion of the wastes will most likely be shipped in barrels or drums via motor freight. Tanks will be used for liquids when there is regular need for transporting large quantities. Rail transport will probably be needed for exceptionally large loads. A flatbed rail car can transport as many as two hundred fifty 55-gallon drums.

Transportation Costs

Freight costs for shipping wet or dry wastes via motor vehicle in 55-gallon drums are listed in Table A-85 and for shipping liquids, slurries, or sludges in tank trucks in Table A-86.

The cost for shipping dry or wet waste materials by rail is about the same for each. For a fixed rate, however, a specification must be submitted to the railroad office for review. Estimates of cost for waste shipment are given in Table A-87. The type of car used (flatbed, gondola, tank, hopper) has little effect on the rate charges.

TABLE A-85

MOTOR VEHICLE FREIGHT RATES FOR SHIPMENTS IN DRUMS[A-62]

Rate, Dollars per Hundredweight

Load Size	Distance, miles 300	200	100	50
Full Load 40,000-44,000 pounds	1.10	1.10	0.80	0.75
Half Load 20,000 pounds	1.20	1.10	0.90	0.83
Single Drum 500 pounds	4.07	4.00	3.90	3.85
Extras	Thirty dollars per stop and no more than three stops per load. An additional cost of $0.70 per mile is assessed for deviations from a normal straight line route.			

TABLE A-86

MOTOR VEHICLE FREIGHT RATES FOR SHIPMENTS IN TANKS[A-63]

Rate, Dollars per Hundredweight

Load Size	Distance, miles			
	300	200	100	50
>32,000 pounds	1.29	0.90	0.52	0.35
>40,000 pounds	1.09	0.77	0.45	0.30
Extras	Extra charges are made for mixed loads at $25 per stop and for attaching and detaching hoses and loading and unloading at $12 per hour.			

TABLE A-87

RAILROAD FREIGHT RATES FOR SHIPMENT OF HAZARDOUS WASTES[A-64]

Rate, Dollars per Hundredweight

Load Size	Distance, miles			
	300	200	100	50
Approximately 24,000 pounds	1.47	1.21	1.00	.75
110,000 pounds	1.31	1.08	.89	.66

SHIPPING REGULATIONS

The quantity of toxic materials which can be shipped in any one container is regulated by the U.S. Department of Transportation. Table A-88 lists some of the quantities of toxic materials in their commercial forms.

Some of these materials are shipped in tank lots of 10,000 gallons or more. They are listed in Table A-89.

SPILLAGE DETECTION METHODS

Prevention, control, and detection of spillage of toxic wastes during transit is a significant concern. Prevention and control would be handled primarily on the basis of selection of containers, size of containers, and rate of dispersion after spillage.

Detection of spillage may be accomplished by either chemical or physical means. The criteria for selection of a detecting device or test are speed of response, reliability, and ruggedness. The following physical tests may also be used.

- Weigh entire shipment
- Weigh drum suspected of leaking
- Measure liquid level in container (tank)
- Measure conductivity of area where spill has occurred
- Measure light transmittance within enclosure
- Measure temperature of shipment

Two chemical tests which can be used to detect spillage are a spot test for specific waste spillage and a sniff test of the thermal conductivity of the atmosphere.

TABLE A-88

DEPARTMENT OF TRANSPORTATION CODE REGULATIONS FOR SHIPMENT OF HAZARDOUS MATERIALS VIA TRUCK OR RAIL[A-65]

Compound	Shipment Size (maximum in one container)
Acrolein	1 qt
Aldrin	200 lbs dry or 1 qt liquid
Ammonium chromate	100 lbs
Ammonium dichromate	100 lbs
Antimony pentafluoride	25 lbs or 1 qt
Arsenic trichloride	55 gals
Arsenic trioxide	200 lbs
Bromine pentafluoride	150 lbs
Calcium arsenate	200 lbs
Calcium arsenite	200 lbs
Calcium cyanide	100 lbs
Chlordane	T.C.
Chlorinated aromatics	T.C.
Chlorine	150 lbs.
Chlorine trifluoride	100 lbs
Chromic acid	100 lbs or 1 gal
Copper arsenate	200 lbs
Copper cyanide	450 lbs
Cuprous cyanide	450 lbs
Dinitrotoluene	tank car (nonrestrictive)

TABLE A-88 (Continued)

Compound	Shipment Size (maximum in one container)
Fluorine	6 lbs
Lead arsenate	200 lbs
Lead arsenite	200 lbs
Lead cyanide	225 lbs
Manganese arsenate	200 lbs
Methyl bromide	55 gal
Methyl chloride	300 lbs
Methyl parathion	100 lbs (27%)
Mercuric chloride	200 lbs
Mercuric cyanide	200 lbs
Mercuric diammonium chloride	200 lbs
Mercuric sulfate	200 lbs
Mercury	55 gals
Nickel carbonyl	Cylinders
Nickel cyanide	200 lbs
Parathion	200 lbs dry or 1 qt liquid
Phosgene	Cylinders (not accepted)
Potassium arsenite	200 lbs
Potassium cyanide	200 lbs dry or 55 gal wet
Silver cyanide	225 lbs
Sodium arsenate	220 lbs
Sodium arsenite	55 gals

TABLE A-88 (Continued)

Compound	Shipment Size (maximum in one container)
Sodium bichromate	
Sodium chromate	
Sodium cyanide	200 lbs dry or 55 gal wet
Zinc arsenate	200 lbs
Zinc arsenite	200 lbs
Zinc cyanide	25 lbs

TABLE A-89

HAZARDOUS MATERIALS SHIPPED IN TANK CAR LOTS OF 10,000 GALLONS OR MORE[A-66]

Acrolein

Dinitrotoluene

Aldrin solution

Antimony pentachloride

Arsenic chloride, liquid

Arsenic acid (containing not over 0.05% NHO_3)

Chlordane

Chlorinated biphenyls

Hydrocyanic acid, stabilized

Potassium cyanide, liquid

Sodium arsenite solution

Sodium bichromate

Sodium cyanide, liquid

APPENDIX M

HAZARDOUS WASTES FACILITIES SITING

PROCEDURE FOR DEVELOPING PARAMETER WEIGHTS

The weighting technique used in assigning relative values to the site-selection criteria is based on the Delphi Procedure. In general, this procedure results in a technique which is systematic in nature, minimizes individual bias, produces consistent comparisons, and aids in the convergence of judgment. The steps followed in this weighting procedure were:

- The details of the weighting procedure were explained to the participants.
- An explanation of the criterion areas, the various parameters involved, and their importance in site selection was presented by a representative of each criterion area to the assembled group of professional participants. Essentially equal time was allotted to each presentation and ensuing questions.
- The four criterion areas were ranked by the individual participants in the following manner. A value of 1 was assigned to the category the individual considered the most important.
- The criterion area considered second most important was compared to the first to determine how much the second was worth compared to the first. This value was expressed as a decimal ($0 < X \leq 1$).
- These pairwise comparisons were continued until all four criterion areas had been evaluated (compared second with first, third with second, and fourth with third).
- The evaluation cards were collected and the percentages were calculated and expressed over a common denominator. The averages over all individuals in the weighting process were calculated.
- The individuals were notified of the results of the weighting procedure. The information included the group mean and variance and other pertinent information.

- The same procedure, without steps 1 and 2, was repeated with the same group of individuals to increase the reliability of the results. The second iteration results showed little change from the first.

An essentially identical procedure was followed by the professional participants in the earth sciences evaluations in arriving at weightings for the four major subcriterion areas of geology, hydrology, climatology, and soils.

Additional information on the background and application of the Delphi Method is presented in the following reports:

> Dakley, N.C., "The Delphi Method: An Experimental Study of Group Opinion," The Rand Corporation, RM-5888-PR (June 1969).
>
> Pill, Jrui, "The Delphi Method: Substance, Context, a Critique and an Annotated Bibliography," Socio-Economic Planning Science, 5, pp 57-71 (1971).

TABLE A-90

SITE SELECTION CRITERIA AREAS

WASTE CONSIDERATIONS

A. GEOGRAPHIC DISTRIBUTION AND DISPERSION OF SOURCES
B. INTRINSIC HAZARD - TYPE AND SEVERITY
C. VOLUME OR OTHER CAPACITY FACTOR
D. UNIQUENESS AND FREQUENCY
E. REGULATORY STATUS

PROCESS CONSIDERATIONS

A. BASIC APPROACH

1. RECOVER AND RECYCLE
2. INERT AND DISPERSE
3. PACKAGE AND STORE

B. ANTICIPATED SITE EFFLUENTS - AIR, WATER, SOLID
C. HAZARD INVENTORY
D. UTILITY NEEDS

GEOLOGIC CONSIDERATIONS

A. ROCK TYPE [RELATED TO ULTIMATE DISPOSAL/STORAGE METHOD(S)]

1. STRATIGRAPHIC SEQUENCE
2. STRUCTURAL RELATIONSHIPS
3. MINERAL POTENTIAL (ECONOMIC)
4. HISTORICAL POTENTIAL (PALEONTOLOGICAL AND ARCHEOLOGICAL)

B. GEOLOGIC HAZARDS

1. EARTHQUAKE RISK
2. TECTONICS (SUBSIDENCE, FAULTS AND FOLDS)
3. LANDSLIDE POTENTIAL
4. VOLCANIC POTENTIAL

PHYSIOGRAPHIC CONSIDERATIONS

A. TOPOGRAPHIC

1. ELEVATION
2. SLOPE
3. ACCESSIBILITY

TABLE A-90 (continued)

B. SOIL TYPES

1. PRIMARY DISPOSAL (STORAGE OF ULTIMATE WASTE PRODUCT)

a. ERODABILITY (TEXTURE, STRUCTURE, PERMEABILITY)
b. DEPTH TO BEDROCK AND GROUNDWATER
c. SORPTION (SUITABILITY/CAPACITY FOR HAZARDOUS MATERIALS)

2. SECONDARY DISPOSAL (LOW-LEVEL OR DILUTE PROCESS WASTE STREAMS)

a. DEPTH TO BEDROCK AND GROUNDWATER
b. SORPTION (SUITABILITY/CAPACITY)
c. LEACHING POTENTIAL

3. ACCIDENTAL SPILLS OF PROCESS FEED OR WASTE STREAMS

a. SOIL TEXTURE AND STRUCTURE
b. DEPTH TO BEDROCK AND GROUNDWATER

4. ENGINEERING LIMITATIONS

HYDROGRAPHY

A. WATERWAYS
B. FLOODPLAINS AND SWAMPS
C. TIDAL BASINS
D. SEICHE POTENTIAL
E. TSUNAMI POTENTIAL

HYDROLOGY

A. CONFINED/UNCONFINED AQUIFERS

1. DEPTH
2. EXTENT
3. POROSITY, PERMEABILITY, TRANSMISSIVITY
4. CHEMISTRY
5. PRESENT AND FUTURE USES

CLIMATOLOGICAL CONSIDERATIONS

A. DIFFUSION CHARACTERISTICS
B. EXTREME CONDITIONS

TABLE A-90 (continued)

1. FREQUENCY AND SEVERITY OF HURRICANES, TORNADOS, THUNDERSTORMS, OTHER LOCAL STORMS AND WINDS

C. POTENTIAL EVAPORATION
D. SEAONSAL CLIMATOLOGY

1. AIR TEMPERATURE
2. RELATIVE HUMIDITY
3. FOG FREQUENCY
4. SOLAR RADIATION

TRANSPORTATION CONSIDERATIONS

A. ECONOMICS AND SAFETY (RISK) WITH RESPECT TO

1. CARRIER (MODE)
2. DISTANCE
3. ROUTING
4. MODAL SPLITS
5. TYPE OF MATERIAL TRANSPORTED
6. SOURCE OF WASTE PRODUCTION
7. VOLUME OF MATERIAL TRANSPORTED

B. ACCESSIBILITY OF TRANSPORTATION

1. RAIL

    a. MAINLINE
    b. SECONDARY

2. HIGHWAY

    a. INTERSTATE AND MAJOR HIGHWAYS
    b. SECONDARY ROADS

3. WATERWAY ACCESS

ACCESSIBILITY OF UTILITIES

A. ELECTRICAL POWER
B. FUELS
C. WATER

TABLE A-90 (continued)

WATER, LAND AND AIR RESOURCES CONSIDERATIONS

A. LAND OWNERSHIP AND PRIOR ASSOCIATION WITH HAZARDOUS WASTES
B. SECURITY AND PUBLIC ACCESS
C. REGULATORY STATUS
D. LIVESTOCK AND GRAZING
E. CROPS AND TIMBER
F. INDUSTRIAL

    1. MINING
    2. LIGHT AND HEAVY MANUFACTURING
    3. COMMERCIAL

G. RECREATIONAL
H. AIR TRANSPORTATION - CORRIDORS AND AIRPORTS
I. WATER

    1. IRRIGATION
    2. COMMERCIAL AND DOMESTIC WATER SUPPLY
    3. SURFACE WATER TRANSPORTATION

J. UNIQUE NATURAL OR HISTORICAL AREAS

HUMAN ENVIRONMENT CONSIDERATIONS

A. DEMOGRAPHY

    1. POPULATION - DISTRIBUTION AND DENSITY

B. PUBLIC ACCEPTANCE
C. AESTHETICS

    1. UNIQUE LANDFORMS, FAUNA OR FLORA COMPOSITIONS
    2. FREQUENCY AND PROXIMITY OF UNIQUE AREAS TO VIEW

BIOLOGICAL CONSIDERATIONS

A. BIRDS AND WILDFOWL

    1. NATIONAL, STATE AND LOCAL REFUGES
    2. MAJOR FLYWAYS INCLUDING SPECIES AND DENSITIES
    3. RARE AND ENDANGERED SPECIES AREAS

B. TERRESTRIAL WILDLIFE

    1. NATIONAL, STATE AND LOCAL REFUGES

TABLE A-90 (continued)

2. ECOSYSTEM QUALITY AND STABILITY
    a. SPECIES DIVERSITY AND DENSITY OF PRODUCERS, HERBIVORES AND CARNIVORES
3. RARE AND ENDANGERED SPECIES AREAS

C. AQUATIC LIFE
1. NATIONAL, STATE AND LOCAL REFUGES
2. ECOSYSTEM QUALITY AND STABILITY
    a. SPECIES DIVERSITY AND DENSITIES OF PRODUCERS, BENTHOS AND FISH
3. RARE AND ENDANGERED SPECIES AREAS

TABLE A-91

EXISTING AND POTENTIAL HAZARDOUS WASTE TREATMENT AND DISPOSAL SITES

Existing Sites Operated by Federal Agencies

USAEC

Hanford Works, Benton County, Washington
Savannah River Plant, Aiken County, South Carolina
National Reactor Testing Station, Bingham County, Idaho
Nevada Test Site, Nye County, Nevada
Oak Ridge, Anderson County, Tennessee
Los Alamos Scientific Laboratory, Los Alamos County, New Mexico
Pantex Plant, Randall County, Texas
Rocky Flats Plant, Jefferson County, Colorado
Fernald, Butler/Hamilton Counties, Ohio

DOD

Edgewood Arsenal, Maryland
Pine Bluff Arsenal, Arkansas
Rocky Mountain Arsenal, Colorado
Tooele Army Depot, Utah
Umatilla Army Depot, Oregon
Anniston Army Depot, Alabama
Pueblo Army Depot, Colorado
Newport Army Ammunition Plant, Indiana
Lexington Bluegrass Army Depot, Kentucky

State Licensed Radioactive Waste

Morehead, Kentucky
Beatty, Nevada
Hanford Works, Washington
West Valley, New York
Sheffield, Illinois

TABLE A-92

COMMERCIAL RADIOACTIVE WASTE BURIAL SITE CHARACTERISTICS

Characteristics	Site
Background	Morehead, Kentucky
Ownership of site	State of Kentucky, leased to NECO
Population - density in area	Rural, sparse (Maxey Flats)
Location re towns and cities	10 mi northwest of Morehead
Area of: (1) site; (2) controlled acres	(1) 200 (est); (2) 1000 (est)
Communications	Fair; state hwy N and S
Precipitation (in.)	46/yr (heavy storms)
Site Characteristics	
Drainage	Well drained
Bedrock depth and materials (est)	50-75 ft (?); shale, sandstone, siltstone
Surficial material - depth; types	50-75 ft (?) shale, clay, siltstone
Groundwater - depth; slope	35-50 ft ("perched" 2-6 ft); erratic
Land and water use downstream	Very little nearby, distant (no data)
General soil characteristics	Very impermeable; good soil sorption
Operation - Equipment and Methods	
Monitoring instruments and devices	Essentially same as at Beatty
Waste handling machinery	Usual - crane; dozer; fork-lifts; etc.
Trenches - (1) dimensions; (2) design; (3) water pumped?	(1) 300 x 50 x depth 20 ft; (2) usual design, sump; (3) Yes
Waste handling - (1) transport by company; (2) processing; (3) burial procedures	(1) and (2) same as Beatty (both NECO); (3) per "Radiation Safety Plan" (NECO)

TABLE A-92 (continued)

COMMERCIAL RADIOACTIVE WASTE BURIAL SITE CHARACTERISTICS

Characteristics	Site
Background	**Beatty, Nevada**
Ownership of site	State of Nevada, leased to NECO
Population - density in area	Desert, virtually uninhabited
Location re towns and cities	About 12 mi southeast of Beatty
Area of (1) site; (2) controlled acres	(1) 80; (2) desert, not controlled
Communications	Good; hwy U.S.95
Precipitation (in.)	2.5-5.0/yr
Site Characteristics	
Drainage	Adequate
Bedrock depth and materials (est)	575+ft; various sedimentary and metamorphic
Surficial material - depth; types	∿575 ft (?); alluvial clay, sand, etc.
Groundwater - depth; slope	275-300 ft; SE∿30 ft/mi
Land and water use downstream	Very little, desert conditions
General soil characteristics	Semi-arid desert; deep soil
Operation - Equipment and Methods	
Monitoring instruments and devices	14 survey instrs; film, air monitors; etc.
Waste handling machinery	Tank truck; trailer trucks; dozer; 35-T crane
Trenches - (1) dimensions; (2) design; (3) water pumped?	(1) 650 x 50 x depth 20 ft; (2) usual design, i.e., drain to sump, 4 ft backfill; (3) no water collected
Waste handling - (1) transport by company; (2) processing; (3) burial procedures	(1) yes; (2) liquids solidified; (3) sp. nu. mat. spaced at bottom, slit trench for high-activity materials

TABLE A-92 (continued)

COMMERCIAL RADIOACTIVE WASTE BURIAL SITE CHARACTERISTICS

Characteristics	Site
Background	**Hanford Works, Washington**
Ownership of site	State of Washington, leased to NECO
Population - density in area	No residents, inside AEC plant
Location re towns and cities	25 mi north of Richland
Area of (1) site; (2) controlled acres	(1) 100; (2) 1000 state owned
Communications	Good, AEC Hanford reservation
Precipitation (in.)	6-8/yr.
Site Characteristics	
Drainage	Well drained
Bedrock depth and materials (est)	250-450 ft; basalt
Surficial material - depth; types	150-350 ft; silty sand, gravel, clay
Ground water - depth; slope	240 ft; N and E ∿ 15-35 ft/mi
Land and water use downstream	Columbia River - all uses
General soil characteristics	Little precipitation; deep dry soil
Operation - Equipment and Methods	
Monitoring instruments and devices	As licensed - survey instrs, film, counters
Waste handling machinery	Usual - crane, shovel, dozer, lifts, etc.
Trenches - (1) dimensions; (2) design; (3) water pumped?	(1) 300 x 60 x depth 25 ft; (2) usual design; (3) no water collects in sump
Waste handling - (1) transport by company; (2) processing; (3) burial procedures	(1) yes, 95%; (2) liquids solidified; (3) sp. nu. mat. spaced, separate trench for ion-exchange resins

TABLE A-92 (continued)

COMMERCIAL RADIOACTIVE WASTE BURIAL SITE CHARACTERISTICS

Characteristics	Site
Background	**West Valley, New York**
Ownership of site	NYASDA, leased to NFS
Population - density in area	Rural, less than 50/sq mi
Location re towns and cities	About 30 mi SW of Buffalo
Area of (1) site: (2) controlled acres	(1) 10+; (2) 3345 state owned
Communications	Good; U.S. hwy and rwy
Precipitation (in.)	40/yr
Site Characteristics	
Drainage	Several creeks
Bedrock depth and materials (est)	50-75 ft; type bedrock not stated
Surficial material - depth; types	25-35 ft glacial till; 25-35 ft silty till
Groundwater - depth; slope	Variable; slopes with surface drainage
Land and water use downstream	Farming; no domestic surface supply
General soil characteristics	Slow water movement; good sorption
Operation - Equipment and Methods	
Monitoring instruments and devices	Variety, types, and numbers - as licensed
Waste handling machinery	Usual - crane, shovel, dozer, lifts, etc.
Trenches - (1) dimensions; (2) design; (3) water pumped?	(1) 700 x 35 x depth 20 ft; (2) usual design, bottom slope 2: 100; (3) yes
Waste handling - (1) transport by company (2) processing; (3) burial procedures	(1) no; (2) no low-level processing; (3) usual, trenches filled, mounded cover

TABLE A-92 (continued)

COMMERCIAL RADIOACTIVE WASTE BURIAL SITE CHARACTERISTICS

Characteristics	Site
Background	Sheffield, Illinois
Ownership of site	State of Illinois, leased to NECO
Population - density of area	Rural, sparse
Location re towns and cities	3 mi SW of Sheffield; others 3-7 mi
Area of (1) site; (2) controlled acres	(1) 27; (2) isolated, not controlled
Communications	Excellent, expressways and 2-lane hwy
Precipitation (in.)	35/yr
Site Characteristics	
Drainage	Intermittent drainage
Bedrock depth and materials (est)	40-60 ft; shale and clay, deeper is sandstone
Surficial material - depth; types	50-60 ft; glacial - silty clay, loess
Groundwater - depth; slope	40-60 ft (SW), 15-25 ft (N); N ∿ 100-150 ft/mi
Land and water use downstream	No specific information; probably limited
General soil characteristics	Low permeabilities; some shallow soil cover
Operation - Equipment and Methods	
Monitoring instruments and devices	Survey instrs; monitoring system and lab
Waste handling machinery	Usual - lifts, dozer, crane, etc.; medium cap
Trenches - (1) dimensions; (2) design; (3) water pumped?	(1) 500 x 40 x depth 20 ft; (2) usual, drain and sump; (3) no
Waste handling - (1) transport by company; (2) processing; (3) burial procedures	(1) yes; (2) liquids solidified - vermiculite and cement; (3) usual, per regulation

TABLE A-93

TABLE A-93

SITES RECOMMENDED BY GSA, FOREST SERVICE, AND BUREAU OF LAND MANAGEMENT

State	County
Arizona	Cochise Maricopa Yuma
California	Inyo Morro
Colorado	Baca Delta Otero Pueblo Weld
Idaho	Banock Power
Illinois	La Salle
Kansas	Morton
Maryland	Prince George
Missouri	Jackson
Montana	Carbon Fergus
Nebraska	Dawes Sioux
Nevada	Clark Esmeralda Humboldt Lander Lincoln Mineral Pershing Washoe
New Mexico	Catron Hidalgo

TABLE A-93 (continued)

SITES RECOMMENDED BY GSA, FOREST SERVICE, AND BUREAU OF LAND MANAGEMENT

State	County
North Dakota	McHenry
Oklahoma	Muskogee
Oregon	Deschutes
	Morrow
South Dakota	Butte
	Fall River
	Meade
Utah	Box Elder
	Iron
	Tooele
Virginia	Pittsylvania
Washington	Franklin
	Lincoln
Wyoming	Campbell

TABLE A-94

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 1 PRIORITY 8 PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
WORCHESTER	MA	3.	4.	3.	5.	390.
MERRIMACK	NH	4.	2.	2.	5.	339.
CARROLL	NH	3.	2.	2.	5.	316.
HILLS BOROUGH	NH	3.	2.	2.	5.	316.
FRANKLIN	ME	4.	1.	2.	5.	311.
OXFORD	ME	4.	2.	2.	4.	308.
CHESHIRE	NH	4.	2.	2.	4.	308.
SOMERSET	ME	3.	2.	2.	4.	285.
PENOBSCOT	ME	4.	2.	2.	3.	277.
SULLIVAN	NH	4.	2.	2.	3.	277.
WALDO	ME	3.	2.	3.	3.	272.
STAFFORD	NH	5.	2.	2.	2.	269.
SUFFOLK	MA	0.	5.	5.	1.	261.
GRAFTON	NH	3.	2.	2.	3.	254.
KENNEBEC	ME	3.	2.	3.	2.	241.
HANCOCK	ME	3.	2.	1.	3.	236.
NEW LONDON	CT	1.	3.	2.	3.	236.
PROVIDENCE	RI	0.	3.	3.	3.	231.
CUMBERLAND	ME	3.	2.	2.	2.	223.
ROCKINGHAM	ME	3.	2.	2.	2.	223.
ANDROSCOGGIN	ME	2.	2.	3.	2.	218.
BELKNAP	NH	4.	1.	2.	2.	218.
COOS	NH	2.	1.	1.	4.	216.
WASHINGTON	ME	2.	2.	1.	3.	213.
YORK	ME	3.	2.	3.	1.	210.
AROOSTOOK	ME	1.	2.	2.	3.	208.
WINDHAM	CT	1.	2.	2.	3.	208.
LINCOLN	ME	2.	2.	2.	2.	200.
MIDDLESEX	MA	0.	3.	3.	2.	200.
PISCATAQUIS	ME	1.	2.	1.	3.	190.
NORFOLK	MA	0.	3.	4.	1.	187.
WASHINGTON	RI	1.	3.	2.	1.	174.
BRISTOL	MA	0.	2.	3.	2.	172.
KENT	RI	0.	2.	3.	2.	172.
SAGADAHOC	ME	2.	2.	2.	1.	169.
KNOX	ME	2.	2.	2.	1.	169.
BRISTOL	RI	0.	1.	5.	1.	149.
PLYMOUTH	MA	1.	2.	2.	1.	146.
ESSEX	MA	0.	2.	2.	1.	123.
BARNSTABLE	MA	0.	2.	1.	1.	105.
NEWPORT	RI	0.	1.	2.	1.	95.
DUKE	MA	0.	1.	2.	1.	95.
NANTUCKET	MA	0.	1.	2.	1.	95.

SORTED WEIGHTED RANKING FO HAZARDOUS WASTE PROCESSING SITES FOR REGION 2 PRIORITY 2B
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORT TION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
FRANKLIN	MA	4.	3.	2.	5.	367.
ALBANY	NY	1.	4.	4.	4.	331.
MONTGOMERY	NY	2.	2.	4.	5.	329.
ESSEX	NJ	0.	5.	5.	3.	323.
UNION	NJ	0.	5.	5.	3.	323.
OSTEGO	NY	3.	2.	4.	4.	321.
SARATOGA	NY	1.	3.	3.	5.	316.
BERKSHIRE	MA	3.	3.	2.	4.	313.
HUNTERDON	NJ	1.	4.	3.	4.	313.
SCHOHARIE	NY	3.	2.	3.	4.	303.
BROOME	NY	1.	3.	4.	4.	303.
SCHNECTADY	NY	1.	4.	4.	3.	300.
COLUMBIA	NY	3.	3.	3.	3.	300.
BENNINGTON	VT	2.	2.	2.	5.	293.
RICHMOND	NJ	0.	5.	5.	2.	292.
KINGS	NY	0.	5.	5.	2.	292.
QUEENS	NY	0.	5.	5.	2.	292.
NASSAU	NY	0.	5.	5.	2.	292.
HUDSON	NJ	0.	5.	5.	2.	292.
HAMPDEN	MA	0.	4.	3.	4.	290.
SOMERSET	NJ	0.	4.	3.	4.	290.
HARTFORD	CT	1.	3.	3.	4.	285.
FRANKLIN	VT	2.	1.	3.	5.	283.
ADDISON	VT	2.	1.	3.	5.	283.
ORANGE	VT	4.	1.	2.	4.	280.
RUTLAND	VT	2.	2.	3.	4.	280.
CHEANGO	NY	2.	2.	3.	4.	280.
HAMPSHIRE	MA	2.	2.	3.	4.	280.
DUTCHESS	NY	2.	3.	3.	3.	277.
WASHINGTON	VT	3.	1.	3.	4.	275.
CALEDONIA	VT	3.	1.	3.	4.	275.
BERGEN	NJ	0.	3.	5.	3.	267.
FRANKLIN	NY	2.	1.	2.	5.	265.
CLINTON	NY	2.	1.	2.	5.	265.
WINDHAM	VT	2.	1.	2.	5.	265.
MERCER	NJ	0.	4.	5.	2.	264.
NEW YORK	NY	0.	5.	5.	1.	261.
BRONX	NY	0.	5.	5.	1.	261.
ORANGE	NY	2.	3.	2.	3.	259.
WASHINGTON	NY	2.	1.	3.	4.	252.
FULTON	NY	2.	1.	3.	4.	252.
ULSTER	NY	2.	1.	3.	4.	252.
LITCHFIELD	CT	2.	2.	3.	3.	249.

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SORTED WEIGHTED RANKIN  FO  HAZARDOUS WASTE PROCESSING SITES FOR REGION   2 PRIORITY 2B        PAGE 2
                  WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY               STATE  HUMAN RESOURCE     TRANSPORTATION       ECOLOGICAL        PHYSICAL/CHEMICAL     WEIGHTED SUM

ESSEX                 VT          2.                1.                  1.                  5.                  247.
WESTCHESTER           NY          0.                4.                  4.                  2.                  246.
SUSSEX                NJ          1.                3.                  2.                  3.                  236.
ORLEANS               VT          2.                1.                  2.                  4.                  234.
SULLIVAN              NY          2.                1.                  2.                  4.                  234.
RENESSELAER           NY          0.                3.                  3.                  3.                  231.
CHITTENDEN            VT          1.                1.                  3.                  4.                  229.
GREENE                NY          1.                1.                  3.                  4.                  229.
LAMOILLE              VT          3.                1.                  2.                  3.                  226.
WINDSOR               VT          3.                1.                  2.                  3.                  226.
WARREN                NY          1.                1.                  1.                  5.                  224.
MONMOUTH              NJ          1.                4.                  3.                  1.                  220.
TOLLAND               CT          2.                2.                  3.                  2.                  218.
NEW HAVEN             CT          0.                3.                  4.                  2.                  218.
PASSAIC               NJ          0.                3.                  4.                  2.                  218.
SUFFOLK               NY          0.                3.                  4.                  2.                  218.
MIDDLESEX             NJ          0.                4.                  4.                  1.                  215.
ESSEX                 NY          1.                1.                  2.                  4.                  211.
PUTNAM                NY          1.                3.                  2.                  2.                  205.
MIDDLESEX             CT          1.                3.                  2.                  2.                  205.
DELEWARE              NY          2.                1.                  2.                  3.                  203.
FAIRFIELD             CT          0.                3.                  3.                  2.                  200.
MORRIS                NJ          0.                3.                  3.                  2.                  200.
HAMILTON              NY          1.                1.                  1.                  4.                  193.
ROCKLAND              NY          0.                3.                  3.                  1.                  169.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 3 PRIORITY 2A PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
ONONDAGA	NY	1.	5	4.	5.	390.
WYOMING	NY	4.	3.	4.	4.	372.
CATTARAUGUS	NY	4.	3.	3.	4.	354.
STEUBEN	NY	4.	3.	3.	4.	354.
TOMPKINS	NY	3.	2.	4.	5.	352.
CORTLAND	NY	3.	2.	3.	5.	334.
SENECA	NY	2.	2.	4.	5.	329.
ERIE	NY	1.	5.	4.	3.	328.
CHEMUNG	NY	0.	3.	4.	5.	311.
TIOGA	NY	0.	3.	4.	5.	311.
ONTARIO	NY	2.	3.	3.	4.	308.
MADISON	NY	1.	2.	4.	5.	306.
SCHUYLER	NY	2.	2.	4.	4.	298.
MCKEAN	PA	5.	3.	2.	2.	297.
ALLEGANY	NY	4.	2.	3.	3.	295.
LEWIS	NY	3.	1.	3.	4.	275.
LIVINGSTON	NY	1.	2.	4.	4.	275.
YATES	NY	2.	1.	4.	4.	270.
ONEIDA	NY	0.	3.	3.	4.	262.
TIOGA	PA	3.	2.	2.	3.	254.
POTTER	PA	4.	2.	2.	2.	246.
CAYUGA	NY	1.	2.	4.	3.	244.
MONROE	NY	0.	5.	4.	1.	243.
BRADFORD	PA	3.	2.	3.	2.	241.
CHAUTAUQUA	NY	2.	2.	4.	2.	236.
ST LAWRENCE	NY	1.	2.	3.	3.	226.
JEFFERSON	NY	2.	3.	3.	1.	215.
HERKIMER	NY	1.	2.	2.	3.	208.
CAMERON	PA	3.	2.	1.	2.	205.
WAYNE	NY	0.	3.	4.	1.	187.
GENESEE	NY	1.	2.	4.	1.	182.
OSWEGO	NY	0.	3.	3.	1.	169.
NIAGARA	NY	0.	2.	4.	1.	159.
ORLEANS	NY	0.	2.	3.	1.	141.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 4 PRIORITY 2C PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
MONTGOMERY	PA	0.	4.	4.	5.	339.
BUCKS	PA	0.	3.	4.	5.	311.
YORK	PA	0.	3.	4.	5.	311.
LEHIGH	PA	2.	4.	4.	2.	292.
BERKS	PA	0.	5.	3.	3.	287.
CLINTON	PA	3.	2.	2.	4.	285.
LANCASTEP	PA	0.	3.	4.	4.	280.
CENTRE	PA	4.	2.	2.	3.	277.
CUMBERLAND	PA	1.	3.	4.	3.	272.
HUNTINGTON	PA	5.	2.	2.	2.	269.
BEDFORD	PA	4.	1.	3.	3.	267.
FULTON	PA	4.	1.	3.	3.	267.
FRANKLIN	PA	4.	2.	3.	2.	264.
MONTOUR	PA	3.	2.	4.	2.	259.
DAUPHIN	PA	0.	4.	3.	3.	259.
WYOMING	PA	3.	2.	2.	3.	254.
MIFFLIN	PA	3.	2.	2.	3.	254.
WARREN	NJ	1.	4.	3.	2.	251.
CHESTER	PA	0.	3.	4.	3.	249.
UNION	PA	3.	1.	3.	3.	244.
ALLEGANY	MD	0.	3.	2.	4.	244.
CAMDEN	NJ	0.	5.	4.	1.	243.
SNYDER	PA	3.	2.	3.	2.	241.
JUNIATA	PA	3.	2.	3.	2.	241.
NO. CUMBERLAND	PA	3.	3.	3.	1.	238.
NORTHAMPTON	PA	1.	4.	4.	1.	238.
PIKE	PA	2.	1.	2.	4.	234.
ADAMS	PA	0.	2.	3.	4.	234.
COLUMBIA	PA	4.	2.	3.	1.	233.
PHILADELPHIA	PA	0.	4.	5.	1.	233.
LACKAWANNA	PA	0.	4.	3.	2.	228.
SCHUTKILL	PA	2.	3.	2.	2.	228.
CARBON	PA	2.	3.	2.	2.	228.
LEBANON	PA	0.	4.	3.	2.	228.
SUSQUEHANNA	PA	1.	2.	3.	3.	226.
BLAIR	PA	1.	3.	3.	2.	223.
CUMBERLAND	NJ	1.	3.	3.	2.	223.
CAPE MAY	NJ	1.	2.	2.	3.	208.
DELAWARE	PA	0.	3.	5.	1.	205.
MONROE	PA	2.	2.	2.	2.	200.
NEWCASTLE	DE	0.	3.	3.	2.	200.
SULLIVAN	PA	3.	1.	2.	2.	195.
LUZERNE	PA	1.	3.	3.	1.	192.

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SORTED WEIGHTED RANKIN  FO  HAZARDOUS WASTE PROCESSING SITES FOR REGION   4 PRIORITY 2C          PAGE 2
                  WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY           STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

PERRY              PA          1.                  3                    3.                  1.                 192.
GLOUCESTER         NJ          0.                  3.                   4.                  1.                 187.
SALEM              NJ          0.                  3.                   4.                  1.                 187.
BURLINGTON         NJ          0.                  3.                   2.                  2.                 182.
ATLANTIC           NJ          0.                  3                    2.                  2.                 182.
LYCOMING           PA          1.                  2.                   2.                  2.                 177.
OCEAN              NJ          1.                  3.                   2.                  1.                 174.
WAYNE              PA          2.                  1.                   2.                  2.                 172.
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SORTED WEIGHTED RANKIN FO: HAZARDOUS WASTE PROCESSING SITES FOR REGION 4 PRIORITY 2C PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
PERRY	PA	1.	3.	3.	1.	192.
GLOUCESTER	NJ	0.	3.	4.	1.	187.
SALEM	NJ	0.	3.	4.	1.	187.
BURLINGTON	NJ	0.	3.	2.	2.	182.
ATLANTIC	NJ	0.	3.	2.	2.	182.
LYCOMING	PA	1.	2.	2.	2.	177.
OCEAN	NJ	1.	3.	2.	1.	174.
WAYNE	PA	2.	1.	2.	2.	172.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 5 PRIORITY 1C PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
WAYNE	OH	3.	3.	4.	5.	380.
MARION	OH	3.	4.	5.	3.	364.
TUSCARAWAS	OH	3.	3.	3.	5.	362.
MADISON	OH	4.	3.	5.	3.	359.
WYANDOT	OH	4.	4.	5.	2.	356.
CRAWFORD	OH	4.	4.	5.	2.	356.
CARROLL	OH	4.	3.	3.	4.	354.
KNOX	OH	3.	2.	4.	5.	352.
HOLMES	OH	3.	2.	4.	5.	352.
CLARION	PA	5.	3.	3.	3.	346.
HARRISON	OH	5.	3.	3.	3.	346.
ASHLAND	OH	4.	3.	4.	3.	341.
COLUMBIANA	OH	5.	2.	4.	3.	336.
MORROW	OH	3.	3.	5.	3.	336.
SENECA	OH	4.	3.	5.	2.	328.
HARDIN	OH	4.	3.	5.	2.	328.
SUMMIT	OH	0.	4.	5.	4.	326.
MEIGS	OH	4.	2.	3.	4.	326.
HURON	OH	4.	4.	5.	1.	325.
MERCER	PA	2.	4.	4.	3.	323.
FRANKLIN	OH	0.	5.	5.	3.	323.
PERRY	OH	4.	3.	3.	3.	323.
COSHOCTON	OH	3.	2.	4.	4.	321.
LICKING	OH	3.	3.	4.	3.	318.
GUERNSEY	OH	5.	2.	3.	3.	318.
FAIRFIELD	OH	3.	3.	4.	3.	318.
JACKSON	OH	5.	2.	3.	3.	318.
STARK	OH	0.	3.	4.	5.	311.
RICHLAND	OH	0.	4.	4.	4.	308.
MAHONING	OH	0.	5.	4.	3.	305.
BEAVER	PA	1.	4.	4.	3.	300.
MUSKINGUM	OH	3.	3.	3.	3.	300.
WETZEL	WV	5.	2.	2.	3.	300.
JACKSON	WV	5.	2.	2.	3.	300.
ERIE	PA	0.	4.	5.	3.	295.
CRAWFORD	PA	2.	3.	4.	3.	295.
BUTLER	PA	2.	3.	4.	3.	295.
BELMONT	OH	2.	3.	4.	3.	295.
CUYAHOGA	OH	0.	5.	5.	2.	292.
ALLEGHENY	PA	0.	5.	5.	2.	292.
UNION	OH	1.	3.	5.	3.	290.
RITCHIE	WV	3.	2.	2.	4.	285.
DODDRIDGE	WV	3.	2.	2.	4.	285.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 5 PRIORITY 1C PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
VENANGO	PA	3.	3.	2.	3.	282.
HANCOCK	OH	2.	3.	5.	2.	282.
PICKAWAY	OH	2.	3.	5.	2.	282.
ATHENS	OH	3.	3.	2.	3.	282.
CLEARFIELD	PA	3.	4.	2.	2.	279.
MORGAN	OH	4.	2.	2.	3.	277.
NOBLE	OH	4.	2.	2.	3.	277.
TYLER	WV	4.	2.	2.	3.	277.
ROSS	OH	2.	3.	3.	3.	277.
ERIE	OH	0.	5.	4.	2.	274.
VINTON	OH	3.	2.	3.	3.	272.
GILMER	WV	5.	1.	2.	3.	272.
ASHTABULA	OH	1.	4.	4.	2.	269.
JEFFERSON	PA	3.	3.	3.	2.	269.
ARMSTRONG	PA	3.	3.	3.	2.	269.
INDIANA	PA	3.	3.	3.	2.	269.
DELAWARE	OH	0.	3.	5.	3.	267.
WOOD	WV	1.	3.	2.	4.	267.
GALLIA	OH	4.	2.	3.	2.	264.
HARRISON	WV	3.	2.	2.	3.	254.
POCAHONTAS	WV	3.	2.	2.	3.	254.
ELK	PA	3.	3.	2.	2.	251.
MEDINA	OH	0.	3.	4.	3.	249.
PORTAGE	OH	0.	3.	4.	3.	249.
LAWRENCE	PA	0.	3.	4.	3.	249.
WIRT	WV	4.	1.	2.	3.	249.
CALHOUN	WV	4.	1.	2.	3.	249.
CAMBRIA	PA	1.	5.	3.	1.	248.
LAKE	OH	0.	4.	4.	2.	246.
TRUMBULL	OH	0.	4.	4.	2.	246.
UPSHUR	WV	4.	2.	2.	2.	246.
MASON	WV	4.	2.	2.	2.	246.
BRAXTON	WV	4.	2.	2.	2.	246.
MERCER	WV	4.	2.	2.	2.	246.
PRESTON	WV	4.	3.	2.	1.	243.
LEWIS	WV	5.	1.	2.	2.	241.
KANAWHA	WV	1.	3.	2.	3.	236.
JEFFERSON	OH	0.	3.	3.	3.	231.
PLEASANTS	WV	2.	2.	2.	3.	231.
LINCOLN	WV	2.	2.	2.	3.	231.
TAYLOR	WV	2.	3.	2.	2.	228.
RANDOLPH	WV	4.	2.	1.	2.	228.
LOGAN	WV	4.	2.	1.	2.	228.

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SORTED WEIGHTED RANKIN  FO  HAZARDOUS WASTE PROCESSING SITES FO  REGION   5 PRIORITY IC          PAGE 3
              WEIGHTS   PHYSICAL =    31.    TRANS    28.   HUMAN =    23.   ECOLOGY =    18.

COUNTY             STATE   HUMAN RESOURCE     TRANSPORTATION        ECOLOGICAL       PHYSICAL/CHEMICAL    WEIGHTED SUM

MINGO               WV          4.                 2.                   1.                  2.                228.
MONROE              OH          3.                 1                    2.                  3.                226.
GREENE              PA          3.                 2                    2.                  2.                223.
FAYETTE             PA          1.                 3                    3.                  2.                223.
BARBOUR             WV          3.                 2.                   2.                  2.                223.
WEBSTER             WV          3.                 2                    2.                  1.                220.
WYOMING             WV          5.                 2.                   1.                  2.                218.
GEAUGA              OH          0.                 3.                   4.                  2.                218.
GRANT               WV          4.                 1.                   2.                  2.                218.
HARDY               WV          4.                 1.                   2.                  2.                218.
PENDLETON           WV          4.                 1.                   2.                  2.                218.
ROANE               WV          4.                 1.                   2.                  2.                215.
SOMERSET            PA          2.                 3.                   3.                  1.                208.
WASHINGTON          OH          1.                 2.                   2.                  3.                205.
CLAY                WV          3.                 2.                   1.                  2.                205.
RALEIGH             WV          3.                 2.                   1.                  2.                200.
WARREN              PA          2.                 2.                   2.                  2.                200.
FOREST              PA          2.                 2.                   2.                  2.                200.
WASHINGTON          PA          0.                 3.                   3.                  2.                200.
OHIO                WV          0.                 3.                   3.                  2.                200.
HOCKING             OH          2.                 2.                   2.                  2.                200.
PUTNAM              WV          2.                 2.                   2.                  2.                200.
GREEN BRIAR         WV          2.                 2.                   2.                  2.                200.
MCDOWELL            WV          4.                 2.                   1.                  1.                197.
MINERAL             WV          3.                 1.                   2.                  2.                195.
NICHOLAS            WV          3.                 1.                   2.                  2.                195.
MONROE              WV          3.                 1.                   2.                  2.                195.
HAMPSHIRE           WV          3.                 2                    2.                  1.                192.
SUMMERS             WV          3.                 2.                   2.                  1.                192.
WEST MORELAND       PA          0.                 3.                   4.                  1.                187.
BOONE               WV          2.                 2.                   1.                  2.                182.
MARSHALL            WV          1.                 2                    2.                  2.                177.
MONONGALIA          WV          1.                 2                    2.                  2.                177.
MARION              WV          1.                 2                    2.                  2.                177.
CABELL              WV          1.                 2                    2.                  2.                177.
TUCKER              WV          3.                 2                    1.                  1.                174.
HANCOCK             WV          0.                 2.                   3.                  2.                172.
GARRETT             MD          2.                 2.                   2.                  1.                169.
LAWRENCE            OH          1.                 1.                   3.                  2.                167.
FAYETTE             WV          2.                 2.                   1.                  1.                151.
WAYNE               WV          1.                 1.                   1.                  2.                131.
LORAIN              OH          1.                 0.                   4.                  1.                126.
BROOKE              WV          0.                 2.                   2.                  1.                123.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 6 PRIORITY 5A

WEIGHTS PHYSICAL = 31. TRANS 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
CAROLINE	VA	5.	2	3.	5.	380.
CARROLL	MD	2.	3.	5.	5.	375.
SPOTSLYVANIA	VA	4.	2.	3.	5.	357.
ORANGE	VA	4.	3.	3.	4.	354.
FREDERICK	MD	3.	2.	4.	5.	352.
FAUQUIER	VA	2.	2.	4.	5.	329.
KING AND QUEEN	VA	4.	2.	3.	4.	326.
BALTIMORE	MD	1.	3.	5.	4.	321.
PRINCE WILLIAM	VA	3.	2.	4.	4.	321.
CULPEPER	VA	3.	2.	4.	4.	321.
BERKELEY	WV	4.	2.	4.	3.	313.
CAROLINE	MD	2.	3.	5.	3.	313.
MONTGOMERY	MD	1.	3.	4.	4.	303.
SHENANDOAH	VA	3.	2.	3.	4.	303.
STAFFORD	VA	4.	2.	3.	3.	295.
FREDERICK	VA	3.	2.	4.	3.	290.
LOUDOUN	VA	2.	1.	5.	4.	288.
WASHINGTON	MD	3.	3.	4.	2.	287.
HARFORD	MD	1.	3.	4.	3.	272.
JEFFERSON	WV	3.	3.	3.	2.	269.
ESSEX	VA	4.	1.	3.	3.	267.
WESTMOR	VA	1.	1.	5.	4.	265.
HOWARD	MD	1.	2.	5.	3.	262.
WARREN	VA	1.	2	3.	4.	257.
MADISON	VA	1.	1.	4.	4.	247.
MORGAN	WV	4.	2.	2.	2.	246.
WICOMICO	MD	1.	2.	4.	3.	244.
ARLINGTON	MD	0.	4.	5.	1.	233.
CECIL	MD	1.	3.	5.	1.	228.
PAGE	VA	1.	2.	3.	3.	226.
KING GEORGE	VA	2.	1.	5.	2.	226.
KENT	DE	1.	3.	3.	2.	223.
ACCOMACK	VA	0.	2.	4.	3.	221.
NORTHAMPTON	VA	0.	2.	4.	3.	221.
FAIRFAX	MD	0.	3.	4.	2.	218.
PRINCE GEORGES	MD	0.	4.	4.	1.	215.
SUSSEX	DE	2.	3.	3.	1.	215.
ANNE ARUNDEL	MD	1.	3.	4.	1.	210.
QUEEN ANNES	MD	1.	2.	5.	1.	200.
TALBOT	MD	1.	2.	5.	1.	200.
CLARKE	VA	1.	2.	3.	2.	195.
ST. MARYS	MD	0.	1.	4.	3.	193.
RICHMOND	VA	0.	1.	4.	3.	193.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  6 PRIORITY SA          PAGE 2
         WEIGHTS   PHYSICAL =    31.   TRANS =    28.   HUMAN =    23.   ECOLOGY =    18.

COUNTY              STATE   HUMAN RESOURCE    TRANSPORTATION    ECOLOGICAL    PHYSICAL/CHEMICAL    WEIGHTED SUM

SOMERSET             MD          0.                2.               4.               2.                190.
WORCESTER            MD          0.                2.               4.               2.                190.
GLOUCESTER           VA          1.                1.               4.               2.                185.
MATHEWS              VA          0.                1.               5.               2.                180.
KENT                 MD          0.                2.               5.               1.                177.
RAPPAHANNOCK         VA          1.                1.               3.               2.                167.
MIDDLESEX            VA          1.                1.               3.               2.                167.
DORCHESTER           MD          1.                2.               3.               1.                164.
CHARLES              MD          1.                2.               3.               1.                164.
NORTHUMBERLAND       VA          0.                1.               4.               2.                162.
CALVERT              MD          1.                1.               4.               1.                154.
LANCASTER            VA          0.                1.               3.               2.                144.
BALTIMORE            MD          0.                4.               0.               1.                143.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 7 PRIORITY GP PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
BRUNSWICK	VA	5.	3.	3.	4.	377.
CHARLOTTE	VA	4.	2.	4.	5.	375.
HALIFAX	VA	4.	2.	4.	5.	375.
PRINCE EDWARD	VA	4.	2.	3.	5.	357.
FLUANNA	VA	5.	2.	3.	4.	349.
ROWAN	NC	3.	3.	4.	4.	349.
DILLON	SC	5.	3.	3.	3.	346.
LOUISA	VA	4.	2.	4.	4.	344.
LUNENBURG	VA	4.	2.	4.	4.	344.
MECKLENBURG	VA	4.	2.	4.	4.	344.
CASWELL	NC	4.	2.	4.	4.	344.
VANCE	NC	4.	2.	4.	4.	344.
WARREN	NC	4.	2.	4.	4.	344.
IREDELL	NC	4.	2.	4.	4.	344.
ALBEMARLE	VA	4.	3.	4.	3.	341.
FLORENCE	SC	4.	3.	4.	3.	341.
HOKE	NC	5.	2.	4.	3.	336.
GUILFORD	NC	1.	4.	4.	4.	331.
WAKE	NC	1.	4.	4.	4.	331.
DARLINGTON	SC	4.	2.	5.	3.	331.
NOTTOWAY	VA	4.	2.	3.	4.	326.
DINWIDDIE	VA	4.	2.	3.	4.	326.
GREENSVILLE	VA	4.	2.	3.	4.	326.
HENRY	VA	4.	2.	3.	4.	326.
AUGUSTA	VA	4.	3.	3.	3.	323.
RICHMOND	NC	4.	3.	3.	3.	323.
SOUTHAMPTON	VA	3.	2.	4.	4.	321.
PITTSYLVANIA	VA	3.	2.	4.	4.	321.
STOKES	NC	3.	2.	4.	4.	321.
ROCKINGHAM	NC	3.	2.	4.	4.	321.
PERSON	NC	3.	2.	4.	4.	321.
DAVIE	NC	3.	2.	4.	4.	321.
HALIFAX	NC	5.	2.	3.	3.	318.
NORTHAMPTON	NC	4.	2.	4.	3.	313.
RUTHERFORD	NC	4.	2.	4.	3.	313.
MARION	SC	4.	3.	2.	3.	305.
FORSYTH	NC	1.	3.	4.	4.	303.
CHATHAM	NC	3.	2.	3.	4.	303.
CHESTERFIELD	SC	3.	2.	3.	4.	303.
APPOMATTOX	VA	2.	2.	4.	4.	298.
CAMPBELL	VA	2.	2.	4.	4.	298.
DAVIDSON	NC	2.	2.	4.	4.	298.
CATAWBA	NC	2.	2.	4.	4.	298.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 7 PRIORITY UP PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
BRUNSWICK	VA	5.	3.	3.	4.	377.
CHARLOTTE	VA	4.	2.	4.	5.	375.
HALIFAX	VA	4.	2.	4.	5.	375.
PRINCE EDWARD	VA	4.	2.	3.	5.	357.
FLUVANNA	VA	5.	2.	3.	4.	349.
ROWAN	NC	3.	3.	4.	4.	349.
DILLON	SC	5.	3.	3.	3.	346.
LOUISA	VA	4.	2.	4.	4.	344.
LUNENBURG	VA	4.	2.	4.	4.	344.
MECKLENBURG	VA	4.	2.	4.	4.	344.
CASWELL	NC	4.	2.	4.	4.	344.
VANCE	NC	4.	2.	4.	4.	344.
WARREN	NC	4.	2.	4.	4.	344.
IREDELL	NC	4.	2.	4.	4.	344.
ALBEMARLE	VA	4.	3.	4.	3.	341.
FLORENCE	SC	4.	3.	4.	3.	341.
HOKE	NC	5.	2.	4.	3.	336.
GUILFORD	NC	1.	4.	4.	4.	331.
WAKE	NC	1.	4.	4.	4.	331.
DARLINGTON	SC	4.	2.	5.	3.	331.
NOTTOWAY	VA	4.	2.	3.	4.	326.
DINWIDDIE	VA	4.	2.	3.	4.	326.
GREENSVILLE	VA	4.	2.	3.	4.	326.
HENRY	VA	4.	2.	3.	4.	326.
AUGUSTA	VA	4.	3.	3.	3.	323.
RICHMOND	NC	4.	3.	3.	3.	323.
SOUTHAMPTON	VA	3.	2.	4.	4.	321.
PITTSYLVANIA	VA	3.	2.	4.	4.	321.
STOKES	NC	3.	2.	4.	4.	321.
ROCKINGHAM	NC	3.	2.	4.	4.	321.
PERSON	NC	3.	2.	4.	4.	321.
DAVIE	NC	3.	2.	4.	4.	321.
HALIFAX	NC	5.	2.	3.	3.	318.
NORTHAMPTON	NC	4.	2.	4.	3.	313.
RUTHERFORD	NC	4.	2.	4.	3.	313.
MARION	SC	4.	3.	2.	3.	305.
FORSYTH	NC	1.	3.	4.	4.	303.
CHATHAM	NC	3.	2.	3.	4.	303.
CHESTERFIELD	SC	3.	2.	3.	4.	303.
APPOMATTOX	VA	2.	2.	4.	4.	298.
CAMPBELL	VA	2.	2.	4.	4.	298.
DAVIDSON	NC	2.	2.	4.	4.	298.
CATAWBA	NC	2.	2.	4.	4.	298.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 7 PRIORITY 5R
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 16.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
LINCOLN	NC	2.	2.	4.	4.	298.
NELSON	VA	4.	2.	3.	3.	295.
SUSSEX	VA	4.	2.	3.	3.	295.
HERTFORD	NC	4.	2.	3.	3.	295.
ROBESON	NC	4.	2.	3.	3.	295.
JOHNSTON	NC	3.	2.	4.	3.	290.
WILSON	NC	3.	2.	4.	3.	290.
CLEVELAND	NC	3.	2.	4.	3.	290.
LEE	NC	3.	2.	4.	3.	290.
HARNETT	NC	3.	2.	4.	3.	290.
ANSON	NC	3.	2.	4.	3.	290.
SCOTLAND	NC	3.	2.	4.	3.	290.
WASHINGTON	TN	3.	3.	4.	2.	287.
DUPLIN	NC	3.	2.	3.	2.	287.
ALAMANCE	NC	2.	2.	5.	3.	285.
ALEXANDER	NC	4.	1.	4.	3.	285.
EDGECOMBE	NC	4.	2.	4.	2.	282.
PITT	NC	4.	2.	4.	2.	282.
AMELIA	VA	2.	2.	3.	4.	280.
AMHERST	VA	2.	3.	3.	3.	277.
JONES	NC	4.	2.	2.	3.	277.
MARLBORO	SC	4.	2.	2.	3.	277.
COLUMBUS	NC	4.	2.	2.	3.	277.
NEW HANOVER	NC	2.	3.	3.	3.	277.
NANSEMOND	VA	2.	4.	3.	2.	274.
KING WILLIAM	VA	3.	2.	3.	3.	272.
NEW KENT	VA	3.	2.	3.	3.	272.
GOOCHLAND	VA	3.	2.	3.	3.	272.
ROCKBRIDGE	VA	3.	2.	3.	3.	272.
BUCKINGHAM	VA	3.	2.	3.	3.	272.
PULASKI	VA	3.	2.	3.	3.	272.
WYTHE	VA	3.	2.	3.	3.	272.
GRANVILLE	NC	3.	2.	3.	3.	272.
FRANKLIN	NC	3.	2.	3.	3.	272.
MOORE	NC	3.	2.	3.	3.	272.
CRAVEN	NC	3.	2.	3.	3.	272.
POLK	NC	3.	2.	3.	3.	272.
ONSLOW	NC	3.	2.	3.	3.	272.
CUMBERLAND	VA	2.	1.	4.	4.	270.
HANOVER	VA	2.	2.	4.	3.	267.
CHESTERFIELD	VA	1.	3.	2.	4.	267.
ISLE OF WIGHT	VA	2.	2.	4.	3.	267.
CABARRUS	NC	2.	2.	4.	3.	267.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 7 PRIORITY 5B PAGE 3

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
STANLEY	NC	2.	2.	4.	3.	267.
FRANKLIN	VA	4.	2.	3.	2.	264.
WAYNE	NC	4.	2.	3.	2.	264.
SAMPSON	NC	4.	2.	3.	2.	264.
FLOYD	VA	3.	1.	4.	3.	262.
UNION	NC	1.	2.	5.	3.	262.
LENOIR	NC	3.	2.	4.	2.	259.
DURHAM	NC	1.	3.	3.	3.	254.
CUMBERLAND	NC	1.	3.	3.	3.	254.
POWHATAN	VA	2.	1.	3.	4.	252.
HENRICO	VA	0.	3.	4.	3.	249.
MECKLENBURG	NC	0.	3.	4.	3.	249.
MONTGOMERY	NC	2.	2.	3.	3.	249.
GREENE	NC	3.	1.	5.	2.	249.
GASTON	NC	1.	2.	4.	3.	244.
ROCKINGHAM	VA	3.	2.	3.	2.	241.
BOTETOURT	VA	3.	2.	3.	2.	241.
BEDFORD	VA	3.	2.	3.	2.	241.
MONTGOMERY	VA	3.	2.	3.	2.	241.
SURRY	NC	3.	2.	3.	2.	241.
NASH	NC	3.	2.	3.	2.	241.
MARTIN	NC	3.	2.	3.	2.	241.
YADKIN	NC	2.	1.	4.	3.	239.
VIRGINIA BEACH	VA	0.	3.	5.	2.	236.
MITCHELL	NC	3.	2.	4.	1.	228.
CHARLES CITY	VA	1.	2.	3.	3.	226.
JAMES CITY	VA	1.	2.	3.	3.	226.
PRINCE GEORGE	VA	1.	2.	3.	3.	226.
ORANGE	NC	1.	2.	3.	3.	226.
RANDOLPH	NC	1.	2.	3.	3.	226.
ALLEGANY	VA	3.	2.	2.	2.	223.
ASHE	NC	4.	1.	4.	1.	223.
ALLEGHANY	NC	4.	1.	4.	1.	223.
GATES	NC	3.	2.	2.	2.	223.
BERTIE	NC	3.	2.	2.	2.	223.
BLADEN	NC	3.	2.	2.	2.	223.
PENDER	NC	3.	2.	2.	2.	223.
HORRY	SC	3.	2.	2.	2.	223.
SURRY	VA	2.	1.	3.	3.	221.
MCDOWELL	NC	3.	3.	2.	1.	220.
SULLIVAN	TN	2.	2.	3.	2.	218.
BEAUFORT	NC	2.	2.	3.	2.	218.
GREENE	VA	3.	1.	3.	2.	213.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 7 PRIORITY 5B PAGE 4
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
CRAIG	VA	3.	1.	3.	2.	213.
UNICOI	TN	3.	2.	3.	1.	210.
BURKE	NC	3.	2.	3.	1.	210.
HAMPTON CITY	VA	0.	2.	5.	2.	208.
PATRICK	VA	4.	1.	3.	1.	205.
HIGHLAND	VA	3.	1.	2.	2.	195.
PASQUOTANK	NC	1.	2.	3.	2.	195.
GILES	VA	3.	2.	2.	1.	192.
SMYTHE	VA	3.	2.	2.	1.	192.
YORK	VA	0.	2.	4.	2.	190.
BRUNSWICK	NC	1.	2.	1.	3.	190.
YANCY	NC	4.	1.	2.	1.	187.
GRAYSON	VA	3.	1.	3.	1.	182.
CARROLL	VA	3.	1.	3.	1.	182.
WATAUGA	NC	3.	1.	3.	1.	182.
WILKES	NC	3.	1.	3.	1.	182.
AVERY	NC	3.	1.	3.	1.	182.
NEWPORT NEWS C	VA	0.	2.	5.	1.	177.
CURRITUCK	NC	1.	2.	2.	2.	177.
PERQUIMANS	NC	1.	2.	2.	2.	177.
CHOWAN	NC	1.	2.	2.	2.	177.
WASHINGTON	NC	1.	2.	2.	2.	177.
PAMLICO	NC	1.	2.	2.	2.	177.
ROANOKE	VA	0.	3.	3.	1.	169.
CHESAPEAKE CITY	VA	0.	3.	3.	1.	169.
CARTERET	NC	0.	2.	1.	3.	167.
BLAND	VA	3.	1.	2.	1.	164.
JOHNSON	TN	3.	1.	2.	1.	164.
CAMDEN	NC	1.	2.	3.	1.	164.
CALDWELL	NC	3.	1.	2.	1.	164.
CARTER	TN	2.	1.	3.	1.	159.
BATH	VA	3.	1.	1.	1.	146.
TYRRELL	NC	1.	1.	1.	2.	131.
HYDE	NC	1.	1.	1.	2.	131.
DARE	NC	0.	1.	0.	2.	90.

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SORTED WEIGHTED RANKIN FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 8 PRIORITY 5C PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
GREENWOOD	SC	4.	3.	5.	5.	421.
RICHMOND	GA	3.	5.	4.	4.	405.
BARNWELL	SC	5.	3.	4.	4.	395.
TELFAIR	GA	4.	4.	3.	4.	382.
TALIAFERRO	GA	4.	2.	4.	5.	375.
JOHNSON	GA	4.	2.	4.	5.	375.
TREUTLEN	GA	4.	2.	4.	5.	375.
DODGE	GA	4.	2.	4.	5.	375.
COFFEE	GA	4.	3.	4.	4.	372.
MORGAN	GA	3.	2.	5.	5.	370.
BLECKLEY	GA	3.	2.	5.	5.	370.
EVANS	GA	5.	2.	4.	4.	367.
WHEELER	GA	4.	4.	2.	4.	364.
BIBB	GA	1.	5.	4.	4.	359.
ELBERT	GA	4.	2.	3.	5.	357.
GREENE	GA	4.	2.	3.	5.	357.
JASPER	GA	4.	2.	3.	5.	357.
PUTNAM	GA	4.	2.	3.	5.	357.
CLARKE	GA	2.	4.	4.	4.	354.
LANCASTER	SC	3.	2.	4.	5.	352.
NEWBERRY	SC	3.	2.	4.	5.	352.
ABBEVILLE	SC	3.	2.	4.	5.	352.
WAYNE	GA	4.	4.	3.	3.	351.
CHESTER	SC	3.	3.	4.	4.	349.
TALBOT	GA	3.	3.	4.	4.	349.
WARREN	GA	4.	2.	4.	4.	344.
HANCOCK	GA	4.	2.	4.	4.	344.
GLASCOCK	GA	4.	2.	4.	4.	344.
WASHINGTON	GA	4.	2.	4.	4.	344.
TOOMBS	GA	4.	2.	4.	4.	344.
PIERCE	GA	4.	3.	4.	3.	341.
BEACH	GA	3.	2.	5.	4.	339.
MACON	GA	3.	2.	5.	4.	339.
MADISON	GA	4.	1.	5.	4.	334.
HART	GA	4.	2.	5.	3.	331.
TROUP	GA	3.	3.	3.	4.	331.
OGLETHORPE	GA	4.	2.	3.	4.	326.
WILKINSON	GA	4.	2.	3.	4.	326.
DUFFIE	GA	3.	2.	4.	4.	321.
SPALDING	GA	3.	2.	4.	4.	321.
MONROE	GA	3.	2.	4.	4.	321.
CRAWFORD	GA	3.	2.	4.	4.	321.
TWIGGS	GA	3.	2.	4.	4.	321.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 8 PRIORITY 5C PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
COWETA	GA	3.	3.	4.	3.	318.
MERIWETHER	GA	3.	3.	4.	3.	318.
WILKES	GA	4.	1.	4.	4.	316.
EMANUEL	GA	4.	2.	4.	3.	313.
JENKINS	GA	4.	2.	4.	3.	313.
TAYLOR	GA	4.	2.	4.	3.	313.
CANDLER	GA	4.	2.	4.	3.	313.
JEFF DAVIS	GA	4.	2.	4.	3.	313.
SALUDA	SC	3.	1.	5.	4.	311.
YORK	SC	3.	2.	5.	3.	308.
LAMAR	GA	3.	2.	5.	3.	308.
MONTGOMERY	GA	4.	2.	2.	4.	308.
LONG	GA	4.	2.	2.	4.	308.
BACON	GA	4.	2.	2.	4.	308.
BAMBERG	SC	5.	2.	4.	2.	305.
FAIRFIELD	SC	3.	2.	3.	4.	303.
JONES	GA	3.	2.	3.	4.	303.
BALDWIN	GA	3.	2.	3.	4.	303.
FAYETTE	GA	2.	2.	4.	4.	298.
UPSON	GA	4.	1.	3.	4.	298.
OCONEE	GA	4.	2.	3.	3.	295.
SCREVEN	GA	4.	2.	3.	3.	295.
LAURENS	GA	4.	2.	3.	3.	295.
BULLOCH	GA	4.	2.	3.	3.	295.
APPLING	GA	4.	2.	3.	3.	295.
LAURENS	SC	3.	2.	4.	3.	290.
KERSHAW	SC	3.	2.	4.	3.	290.
JACKSON	GA	3.	2.	4.	3.	290.
SUMTER	SC	3.	2.	4.	3.	290.
NEWTON	GA	3.	2.	4.	3.	290.
BUTTS	GA	3.	2.	4.	3.	290.
JEFFERSON	GA	3.	2.	4.	3.	290.
PIKE	GA	3.	2.	4.	3.	290.
CALHOUN	SC	2.	2.	5.	3.	285.
HENRY	GA	2.	2.	5.	3.	285.
LEE	SC	4.	2.	4.	2.	282.
ORANGEBURG	SC	4.	2.	4.	2.	282.
BURKE	GA	4.	2.	4.	2.	282.
WARE	GA	3.	3.	2.	3.	282.
WALTON	GA	3.	1.	5.	3.	280.
AIKEN	SC	2.	2.	3.	4.	280.
CHATHAM	GA	1.	5.	3.	2.	279.
BARROW	GA	3.	2.	5.	2.	277.

SORTED WEIGHTED RANKIN FO HAZARDOUS WASTE PROCESSING SITES FO REGION 8 PRIORITY SC PAGE 3
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
TATTNALL	GA	4.	2.	2.	3.	277.
RICHLAND	SC	0.	5.	4.	2.	274.
SPARTANBURG	SC	1.	3.	4.	3.	272.
FRANKLIN	GA	4.	1.	5.	2.	272.
MCCORMICK	SC	3.	2.	3.	3.	272.
HARRIS	GA	3.	2.	3.	3.	272.
EDGEFIELD	SC	2.	2.	4.	3.	267.
COLUMBIA	GA	2.	2.	4.	3.	267.
ALLENDALE	SC	4.	2.	3.	2.	264.
HAMPTON	SC	4.	2.	3.	2.	264.
LINCOLN	GA	3.	1.	4.	3.	262.
BANKS	GA	4.	2.	4.	1.	251.
EFFINGHAM	GA	3.	3.	2.	2.	251.
UNION	SC	2.	2.	3.	3.	249.
ANDERSON	SC	3.	2.	5.	1.	246.
LIBERTY	GA	4.	2.	2.	2.	246.
BRANTLEY	GA	4.	2.	2.	2.	246.
LEXINGTON	SC	1.	2.	4.	3.	244.
ROCK	GA	1.	2.	4.	3.	244.
HOUSTON	GA	1.	2.	4.	3.	244.
PULASKE	GA	3.	1.	3.	3.	244.
WILLIAMSBURG	SC	3.	2.	3.	2.	241.
CHEROKEE	SC	2.	2.	4.	2.	236.
BRYAN	GA	4.	3.	1.	1.	225.
DORCHESTER	SC	3.	3.	2.	1.	220.
JASPER	SC	3.	3.	2.	1.	220.
CLARENDON	SC	2.	2.	3.	2.	218.
OCONEE	SC	3.	2.	3.	1.	210.
COLLETON	SC	3.	2.	3.	1.	210.
CHARLESTON	SC	0.	5.	2.	1.	207.
BERKELEY	SC	1.	3.	1.	2.	187.
PICKENS	SC	1.	2.	4.	1.	182.
GREENVILLE	SC	0.	2.	5.	1.	177.
CAMDEN	GA	1.	2.	2.	2.	177.
BEAUFORT	SC	2.	2.	2.	1.	169.
MCINTOSH	GA	1.	2.	1.	2.	159.
GLYNN	GA	1.	2.	1.	2.	159.
CHARLTON	GA	2.	2.	1.	1.	151.
GEORGETOWN	SC	1.	2.	2.	1.	146.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 9 PRIORITY PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
UNION	FL	4.	5.	1.	4.	374.
PUTNAM	FL	4.	4.	1.	4.	346.
MARION	FL	4.	2.	2.	5.	339.
HIGHLANDS	FL	3.	2.	3.	5.	334.
ALACHUA	FL	3.	3.	3.	4.	331.
CLAY	FL	4.	2.	1.	5.	321.
HARDEE	FL	3.	2.	4.	4.	321.
OSCEOLA	FL	4.	1.	2.	5.	311.
BRADFORD	FL	4.	2.	2.	4.	308.
SUMTER	FL	4.	2.	2.	4.	308.
OKEECHOBEE	FL	3.	2.	3.	4.	303.
DE SOTO	FL	4.	2.	3.	3.	295.
ORANGE	FL	1.	3.	3.	4.	285.
GLADES	FL	3.	2.	2.	4.	285.
POLK	FL	1.	3.	2.	4.	267.
LAKE	FL	3.	2.	2.	3.	254.
BAKER	FL	2.	3.	1.	3.	241.
HILLSBOROUGH	FL	0.	4.	2.	3.	241.
MANATEE	FL	2.	2.	2.	3.	231.
HENDRY	FL	2.	2.	2.	3.	231.
SEMINOLE	FL	1.	2.	3.	3.	226.
PASCO	FL	2.	2.	1.	3.	213.
HERNANDO	FL	3.	2.	1.	2.	205.
ST. JOHNS	FL	2.	2.	2.	2.	200.
CHARLOTTE	FL	3.	2.	2.	1.	192.
COLLIER	FL	2.	1.	1.	3.	185.
FLAGLER	FL	2.	2.	1.	2.	182.
DADE	FL	0.	4.	2.	1.	179.
VOLUSIA	FL	1.	2.	2.	2.	177.
SARASOTA	FL	1.	2.	2.	2.	177.
CITRUS	FL	3.	2.	1.	1.	174.
ST. LUCIE	FL	2.	2.	2.	1.	169.
MARTIN	FL	2.	2.	2.	1.	169.
PINELLA	FL	0.	2.	4.	1.	159.
INDIAN RIVER	FL	2.	2.	1.	1.	151.
DUVAL	FL	1.	2.	2.	1.	146.
PALM BEACH	FL	1.	2.	2.	1.	146.
NASSAU	FL	1.	1	1.	2.	131.
BREVARD	FL	1.	2.	1.	1.	128.
LEE	FL	1.	2.	1.	1.	128.
BROWARD	FL	1.	2.	1.	1.	128.
MONROE	FL	0.	1.	0.	2.	90.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 10 PRIORITY 7R PAGE 3
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 16.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
CALHOUN	FL	4.	2.	1.	3.	259.
MUSCOGEE	GA	1.	3.	3.	3.	254.
WALTON	FL	3.	2	2.	3.	254.
JEFFERSON	FL	3.	2.	2.	3.	254.
MACON	AL	2.	2	3.	3.	249.
CHATTAHOOCHEE	GA	4.	2.	2.	2.	246.
AUTAUGA	AL	3.	2.	3.	2.	241.
LIBERTY	FL	3.	2.	1.	3.	236.
TAYLOR	FL	3.	2.	1.	3.	236.
OKALOOSA	FL	4.	2.	1.	2.	228.
MOBILE	AL	0.	5.	2.	1.	207.
DIXIE	FL	3.	2.	1.	2.	205.
LEVY	FL	3.	2.	1.	2.	205.
ELMORE	AL	1.	2.	3.	2.	195.
WAKULLA	FL	2.	2.	1.	2.	182.
RUSSELL	AL	1.	2.	2.	2.	177.
SANTA ROSA	FL	1.	2.	2.	2.	177.
BAY	FL	1.	2.	1.	2.	159.
GULF	FL	1.	2.	1.	2.	159.
FRANKLIN	FL	1.	2.	1.	2.	159.
LEON	FL	0.	2.	2.	2.	154.
STONE	MS	0.	0.	1.	4.	142.
GEORGE	MS	0.	0.	1.	4.	142.
BALDWIN	AL	0.	2.	2.	1.	123.
ESCAMBIA	FL	0.	2.	2.	1.	123.
HANCOCK	MS	0.	2.	1.	1.	105.
HARRISON	MS	0.	2.	1.	1.	105.
JACKSON	MS	0.	2.	1.	1.	105.
PEARL RIVER	MS	0.	0.	1.	2.	80.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  10 PRIORITY 7B          PAGE 2
                 WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE  HUMAN RESOURCE     TRANSPORTATION      ECOLOGICAL      PHYSICAL/CHEMICAL     WEIGHTED SUM

MONROE             AL         4.                 2.                2.                 4.                 308.
CONECUH            AL         4.                 2.                2.                 4.                 308.
BERRIEN            GA         4.                 2.                2.                 4.                 308.
ATKINSON           GA         4.                 2.                2.                 4.                 308.
COOK               GA         4.                 2.                2.                 4.                 308.
GENEVA             AL         4.                 2.                2.                 4.                 308.
NESHOBA            MS         3.                 2.                3.                 4.                 303.
JASPER             MS         3.                 2.                3.                 4.                 303.
BULLOCK            AL         3.                 2.                3.                 4.                 303.
LEE                AL         3.                 3.                3.                 3.                 300.
BUTLER             AL         5.                 2.                2.                 3.                 300.
PERRY              MS         3.                 2.                1.                 5.                 298.
LOWNDES            AL         4.                 2.                3.                 3.                 295.
SUMTER             GA         4.                 2.                3.                 3.                 295.
COFFEE             AL         4.                 2.                3.                 3.                 295.
DALE               AL         4.                 2.                3.                 3.                 295.
COVINGTON          MS         4.                 2.                3.                 3.                 295.
LOWNDES            GA         4.                 2.                3.                 3.                 295.
GILCHRIST          FL         4.                 2.                3.                 3.                 295.
CHOCTAW            AL         4.                 2.                1.                 4.                 290.
PIKE               AL         3.                 2.                4.                 3.                 290.
LAFAYETTE          FL         4.                 2.                1.                 4.                 290.
LEAKE              MS         3.                 1.                2.                 5.                 288.
SCOTT              MS         3.                 2.                2.                 4.                 285.
DOUGHERTY          GA         1.                 3.                3.                 4.                 285.
ESCAMBIA           AL         3.                 2.                2.                 4.                 285.
SMITH              MS         2.                 1.                3.                 5.                 283.
LANIER             GA         4.                 2.                2.                 3.                 277.
HOLMES             FL         4.                 2.                2.                 3.                 277.
MADISON            FL         4.                 2.                2.                 3.                 277.
HAMILTON           FL         4.                 2.                2.                 3.                 277.
MONTGOMERY         AL         0.                 5.                4.                 2.                 274.
BARBOUR            AL         3.                 2.                3.                 3.                 272.
GADSEN             FL         3.                 2.                3.                 3.                 272.
WASHINGTON         FL         5.                 1.                2.                 3.                 272.
DALLAS             AL         3.                 3.                3.                 2.                 269.
WASHINGTON         AL         3.                 2.                1.                 4.                 267.
WAYNE              MS         3.                 2.                1.                 4.                 267.
GREENE             MS         3.                 2.                1.                 4.                 267.
FORREST            MS         3.                 3.                1.                 3.                 264.
COVINGTON          AL         4.                 2.                3.                 2.                 264.
CLINCH             GA         4.                 2.                1.                 3.                 259.
ECHOLS             GA         4.                 2.                1.                 3.                 259.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 10 PRIORITY 7B PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
DOOLEY	GA	5.	4.	4.	5.	454.
CRISP	GA	4.	4.	4.	4.	400.
TURNER	GA	5.	2.	4.	4.	367.
TIFT	GA	5.	2.	4.	4.	367.
KEMPER	MS	4.	2.	3.	5.	357.
LEE	GA	4.	2.	3.	5.	357.
CALHOUN	GA	4.	2.	3.	5.	357.
SUWANNEE	FL	4.	2.	3.	5.	357.
NEWTON	MS	4.	3.	3.	4.	354.
RANDOLPH	GA	4.	3.	3.	4.	354.
TERRELL	GA	4.	3.	3.	4.	354.
JONES	MS	4.	4.	3.	3.	351.
WEBSTER	GA	[illegible]	2.	4.	4.	344.
WILCOX	GA	4.	2.	4.	4.	344.
EARLY	GA	[illegible]	2.	4.	4.	344.
MITCHELL	GA	4.	2.	4.	4.	344.
COLQUITT	GA	4.	2.	4.	4.	344.
THOMAS	GA	4.	2.	4.	4.	344.
COLUMBIA	FL	4.	3.	2.	4.	336.
SUMTER	AL	4.	2.	3.	4.	326.
MARION	GA	4.	2.	3.	4.	326.
SCHLEY	GA	4.	2.	3.	4.	326.
CLAY	GA	4.	2.	3.	4.	326.
IRWIN	GA	4.	2.	3.	4.	326.
MILLER	GA	4.	2.	3.	4.	326.
SEMINOLE	GA	4.	2.	3.	4.	326.
DECATUR	GA	4.	2.	3.	4.	326.
BROOKS	GA	4.	2.	3.	4.	326.
CRENSHAW	AL	3.	2.	4.	4.	321.
WORTH	GA	3.	2.	4.	4.	321.
GRADY	GA	3.	2.	4.	4.	321.
BAKER	GA	3.	2.	2.	5.	316.
BEN HILL	GA	4.	2.	4.	3.	313.
HENRY	AL	4.	2.	4.	3.	313.
LAMAR	MS	5.	2.	1.	4.	313.
HOUSTON	AL	4.	2.	4.	3.	313.
LAUDERDALE	MS	3.	4.	2.	3.	310.
MARENGO	AL	4.	2.	2.	4.	308.
CLARKE	MS	4.	2.	2.	4.	308.
WILCOX	AL	4.	2.	2.	4.	308.
STEWART	GA	4.	2.	2.	4.	308.
QUITMAN	GA	4.	2.	2.	4.	308.
CLARKE	AL	4.	2.	2.	4.	308.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 11 PRIORITY 7A PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
JEFFERSON	TN	3.	5.	3.	3.	356.
MONTGOMERY	TN	4.	3.	3.	4.	354.
LEWIS	TN	4.	2.	2.	5.	339.
MARION	AL	4.	2.	2.	5.	339.
FAYETTE	AL	4.	2.	2.	5.	339.
OVERTON	TN	4.	1.	3.	5.	329.
WHITE	TN	4.	2.	3.	4.	326.
WARREN	TN	4.	2.	3.	4.	326.
MARSHALL	TN	4.	2.	3.	4.	326.
LAWRENCE	TN	4.	2.	3.	4.	326.
FRANKLIN	AL	4.	2.	3.	4.	326.
LAMAR	AL	4.	2.	3.	4.	326.
RANDOLPH	AL	4.	2.	3.	4.	326.
ROBERTSON	TN	3.	2.	4.	4.	321.
MARSHALL	AL	3.	2.	4.	4.	321.
CULLMAN	AL	3.	2.	4.	4.	321.
DE KALB	AL	5.	2.	3.	3.	318.
JEFFERSON	AL	0.	5.	3.	4.	318.
STEWART	TN	3.	2.	2.	5.	316.
CHEATHAM	TN	3.	2.	2.	5.	316.
WINSTON	AL	3.	2.	2.	5.	316.
BIBB	AL	3.	2.	2.	5.	316.
HUMPHREYS	TN	4.	2.	2.	4.	308.
HICKMAN	TN	4.	2.	2.	4.	308.
COFFEE	TN	4.	2.	2.	4.	308.
GRUNDY	TN	4.	2.	2.	4.	308.
PICKENS	AL	4.	2.	2.	4.	308.
HOUSTON	TN	3.	2.	3.	4.	303.
DICKSON	TN	3.	2.	3.	4.	303.
WAYNE	TN	5.	1.	2.	4.	303.
GILES	TN	3.	2.	3.	4.	303.
LIMESTONE	AL	1.	3.	4.	4.	303.
LAWRENCE	AL	3.	2.	3.	4.	303.
BLOUNT	AL	3.	2.	3.	4.	303.
PERRY	AL	3.	2.	3.	4.	303.
TALLAPOOSA	AL	3.	2.	3.	4.	303.
CALHOUN	AL	3.	3.	3.	3.	300.
TALLADEGA	AL	3.	3.	3.	3.	300.
MACON	TN	4.	1.	3.	4.	298.
JACKSON	TN	4.	1.	3.	4.	298.
PUTNAM	TN	4.	2.	3.	3.	295.
MAURY	TN	4.	2.	3.	3.	295.
MCMINN	TN	4.	2.	3.	3.	295.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 11 PRIORITY 7A PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
GORDON	GA	4.	2.	3.	3.	295.
BARTOW	GA	4.	2.	3.	3.	295.
SCOTT	TN	4.	2.	1.	4.	290.
CHAMBERS	AL	3.	2.	4.	3.	290.
MORGAN	TN	3.	2.	2.	4.	285.
BLEDSOE	TN	3.	2.	2.	4.	285.
CLEBURNE	AL	3.	2.	2.	4.	285.
HAMILTON	TN	1.	4.	3.	3.	282.
CLAY	TN	4.	1.	2.	4.	280.
FENTRESS	TN	4.	1.	2.	4.	280.
VAN BUREN	TN	4.	1.	2.	4.	280.
PERRY	TN	4.	1.	2.	4.	280.
FRANKLIN	TN	2.	2.	3.	4.	280.
CHEROKEE	AL	2.	2.	3.	4.	280.
CLAIBORNE	TN	4.	2.	2.	3.	277.
DAVIDSON	TN	0.	4.	4.	3.	277.
SEQUATCHIE	TN	4.	2.	2.	3.	277.
PICKETT	TN	3.	1.	3.	4.	275.
TROUSDALE	TN	3.	1.	3.	4.	275.
SMITH	TN	3.	1.	3.	4.	275.
DE KALB	GA	0.	5.	4.	2.	274.
KNOX	TN	1.	3.	4.	3.	272.
BEDFORD	TN	3.	2.	3.	3.	272.
JACKSON	AL	3.	2.	3.	3.	272.
COLBERT	AL	3.	2.	3.	3.	272.
MORGAN	AL	3.	2.	3.	3.	272.
FLOYD	GA	3.	2.	3.	3.	272.
CARROLL	GA	3.	2.	3.	3.	272.
HALE	AL	3.	2.	3.	3.	272.
CHILTON	AL	3.	2.	3.	3.	272.
LINCOLN	TN	2.	2.	4.	3.	267.
SHELBY	AL	1.	3.	2.	4.	267.
FORSYTH	GA	3.	2.	4.	2.	259.
SUMNER	TN	1.	2.	3.	4.	257.
WILLIAMSON	TN	1.	2.	3.	4.	257.
TUSCALOOSA	AL	1.	2.	3.	4.	257.
FULTON	GA	0.	5.	3.	2.	256.
CUMBERLAND	TN	3.	2.	2.	3.	254.
MURRAY	GA	3.	2.	2.	3.	254.
SAINT CLAIR	AL	1.	3.	3.	3.	254.
CLAY	AL	3.	2.	2.	3.	254.
GREENE	AL	3.	2.	2.	3.	254.
UNION	TN	2.	2.	3.	3.	249.

SORTED WEIGHTE RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 11 PRIORITY 7A PAGE 3
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
RUTHERFORD	TN	2.	2.	3.	3.	249.
BRADLEY	TN	2.	2.	3.	3.	249.
LAUDERDALE	AL	2.	2.	3.	3.	249.
WHITEHEAD	GA	2.	2.	3.	3.	249.
CHATTOOGA	CA	2.	2.	3.	3.	249.
PICKENS	GA	4.	2.	2.	2.	246.
POLK	GA	4.	2.	2.	2.	246.
HANCOCK	TN	3.	1.	3.	3.	244.
GRAINGER	TN	3.	1.	3.	3.	244.
MEIGS	TN	3.	1.	3.	3.	244.
MOORE	TN	3.	1.	3.	3.	244.
CATOOSA	GA	1.	2.	4.	3.	244.
HEARD	GA	3.	1.	3.	3.	244.
HAWKINS	TN	3.	2.	3.	2.	241.
GREENE	TN	3.	2.	3.	2.	241.
COCKE	TN	3.	2.	3.	2.	241.
HALL	GA	3.	2.	3.	2.	241.
HARALSON	GA	3.	2.	3.	2.	241.
WALKER	AL	1.	2.	2.	4.	239.
MARION	TN	2.	2.	2.	3.	231.
ETOWAH	AL	0.	3.	3.	3.	231.
PAULDING	GA	2.	2.	2.	3.	231.
DEKALB	TN	1.	1.	3.	4.	229.
CANNON	TN	1.	1.	3.	4.	229.
LOUDON	TN	1.	2.	3.	3.	226.
WALKER	GA	1.	2.	3.	3.	226.
COOSA	LA	3.	1.	2.	3.	226.
CAMPBELL	TN	3.	2.	2.	2.	223.
MONROE	TN	3.	2.	2.	2.	223.
POLK	TN	3.	2.	2.	2.	223.
CHEROKEE	GA	3.	2.	2.	2.	223.
COBB	GA	1.	3.	3.	2.	223.
HAMBLEN	TN	2.	2.	3.	2.	218.
GILMER	GA	4.	2.	2.	1.	215.
ANDERSON	TN	1.	2.	2.	3.	208.
DADE	GA	1.	2.	2.	3.	208.
RHEA	TN	2.	1.	2.	3.	203.
ROANE	TN	2.	1.	2.	3.	203.
MADISON	AL	0.	2.	3.	3.	203.
DOUGLAS	GA	2.	2.	2.	2.	200.
WILSON	TN	1.	2.	3.	2.	195.
GWINNETT	GA	1.	2.	3.	2.	195.
CHEROKEE	NC	3.	2.	2.	1.	192.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 11 PRIORITY 7A          PAGE 4
                       WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE  HUMAN RESOURCE     TRANSPORTATION      ECOLOGICAL      PHYSICAL/CHEMICAL    WEIGHTED SUM

FANNIN             GA         3.                 2                  2.                1.                 192.
TOWNS              GA         3.                 2                  2.                1.                 192.
HENDERSON          NC         2.                 2.                 3.                1.                 187.
LUMPKIN            GA         4.                 1.                 2.                1.                 187.
DAWSON             GA         4.                 1.                 2.                1.                 187.
CLAY               NC         3.                 1.                 3.                1.                 182.
BLOUNT             TN         1.                 2.                 2.                2.                 177.
UNION              GA         3.                 2.                 1.                1.                 174.
MADISON            NC         2.                 2.                 2.                1.                 169.
JACKSON            NC         2.                 2.                 2.                1.                 169.
TRANSYLVANIA       NC         2.                 2.                 2.                1.                 169.
RABUN              GA         2.                 2.                 2.                1.                 169.
STEPHENS           GA         2.                 2.                 2.                1.                 169.
MACON              NC         3.                 1.                 2.                1.                 164.
GRAHAM             NC         2.                 2.                 1.                1.                 151.
SEVIER             TN         1.                 1.                 2.                2.                 149.
SWAIN              NC         1.                 2.                 2.                1.                 146.
HAYWARD            NC         1.                 2.                 2.                1.                 146.
BUNCOMBE           NC         0.                 2.                 3.                1.                 141.
WHITE              GA         2.                 1.                 2.                1.                 141.
HABERSHAM          GA         2.                 1.                 2.                1.                 141.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 12 PRIORITY 1D

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
JACKSON	IN	4.	4.	4.	4.	400.
JAY	IN	4.	3.	5.	4.	390.
FAYETTE	IN	4.	3.	5.	4.	390.
PUTNAM	IN	3.	4.	4.	4.	377.
WAYNE	IN	3.	3.	5.	4.	367.
CUMBERLAND	IL	3.	3.	5.	4.	367.
LOGAN	KY	5.	2.	4.	4.	367.
MERCER	OH	4.	3.	5.	3.	359.
AUGLAIZE	OH	4.	3.	5.	3.	359.
RANDOLPH	IN	4.	3.	5.	3.	359.
LAKE	OH	4.	3.	5.	3.	359.
DOUGLAS	IL	4.	3.	5.	3.	359.
COLES	IL	4.	3.	5.	3.	359.
HENRY	IN	4.	3.	5.	3.	359.
FAYETTE	OH	4.	3.	5.	3.	359.
RUSH	IN	4.	3.	5.	3.	359.
DECATUR	IN	4.	3.	5.	3.	359.
OHIO	KY	4.	2.	3.	5.	357.
OWEN	IN	4.	2.	4.	4.	344.
UNION	IN	4.	3.	4.	3.	341.
JENNINGS	IN	4.	3.	4.	3.	341.
FRANKLIN	KY	4.	3.	4.	3.	341.
LOGAN	OH	3.	3.	5.	3.	336.
EDGAR	IL	3.	3.	5.	3.	336.
CRAWFORD	IL	3.	3.	5.	3.	336.
HIGHLAND	OH	5.	2.	4.	3.	336.
TODD	KY	5.	2.	4.	3.	336.
GRAYSON	KY	3.	2.	3.	5.	334.
SHELBY	OH	3.	4.	5.	2.	333.
SIMPSON	KY	4.	2.	5.	3.	331.
BUTLER	KY	4.	1.	3.	5.	329.
HAMILTON	OH	0.	5.	5.	3.	323.
PIKE	OH	4.	3.	3.	3.	323.
DUBOIS	IN	4.	3.	3.	3.	323.
DEARBORN	IN	3.	2.	4.	4.	321.
MASON	KY	3.	2.	4.	4.	321.
WEBSTER	KY	3.	2.	4.	4.	321.
JASPER	IL	3.	3.	4.	3.	318.
HENRY	KY	3.	3.	4.	3.	318.
MUHLENBERG	KY	3.	2.	2.	5.	316.
RIPLEY	IN	4.	2.	4.	3.	313.
SCOTT	IN	4.	2.	4.	3.	313.
JEFFERSON	IN	4.	2.	4.	3.	313.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 12 PRIORITY ID PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORT TION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
NICHOLAS	KY	4.	2.	4.	3.	313.
HOPKINS	KY	3.	3.	2.	4.	313.
WARREN	KY	4.	2.	4.	3.	313.
RICHLAND	IL	4.	3.	4.	2.	310.
TIPTON	IN	3.	2.	5.	3.	308.
CHAMPAIGN	OH	3.	3.	5.	2.	305.
KNOX	IN	3.	3.	5.	2.	305.
PULASKI	KY	3.	2.	3.	4.	303.
CLINTON	OH	4.	2.	5.	2.	300.
DAVIESS	IN	4.	2.	5.	2.	300.
FLOYD	KY	5.	2.	2.	3.	300.
ROCKCASTLE	KY	3.	3.	3.	3.	300.
BROWN	OH	2.	2.	4.	4.	298.
FLEMING	KY	4.	1.	3.	4.	298.
LAWRENCE	IN	3.	4.	3.	2.	297.
DELAWARE	IN	0.	4.	5.	3.	295.
WASHINGTON	IN	4.	2.	3.	3.	295.
SCOTT	KY	2.	3.	4.	3.	295.
BOURBON	KY	2.	3.	4.	3.	295.
MADISON	KY	4.	2.	3.	3.	295.
DAVIESS	KY	2.	3.	4.	3.	295.
BRACKEN	KY	3.	1.	4.	4.	293.
MARION	IN	0.	5.	5.	2.	292.
GIBSON	IN	2.	4.	4.	2.	292.
CLARK	KY	2.	4	4.	2.	292.
FRANKLIN	IN	3.	2.	4.	3.	290.
PENDLETON	KY	3.	2.	4.	3.	290.
HARRISON	KY	3.	2.	4.	3.	290.
SPENCER	IN	3.	2.	4.	3.	290.
HART	KY	3.	2.	4.	3.	290.
CHRISTIAN	KY	3.	2.	4.	3.	290.
GREENE	IN	3.	3.	4.	2.	287.
LAWRENCE	IL	3.	3.	4.	2.	287.
CLARK	IL	2.	2.	5.	3.	285.
OWEN	KY	4.	1.	4.	3.	285.
ROBERTSON	KY	4.	1.	4.	3.	285.
WASHINGTON	KY	4.	1.	4.	3.	285.
MCLEAN	KY	4.	1.	4.	3.	285.
ALLEN	KY	4.	1.	4.	3.	285.
ANDERSON	KY	4.	2.	4.	2.	282.
POSEY	IN	2.	3.	5.	2.	282.
HARDIN	KY	5.	2.	1.	3.	282.
VIGO	IN	0.	3.	4.	4.	280.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 12 PRIORITY ID

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
CALDWELL	KY	2.	2.	3.	4.	280.
BARTHOLOMEW	IN	3.	2.	5.	2.	277.
BOYLE	KY	2.	3.	3.	3.	277.
HANCOCK	KY	3.	1.	3.	4.	275.
JEFFERSON	KY	0.	5.	4.	2.	274.
ADAMS	OH	3.	2.	3.	3.	272.
MONTGOMERY	KY	3.	2.	3.	3.	272.
MEADE	KY	3.	2.	3.	3.	272.
LINCOLN	KY	3.	2.	3.	3.	272.
PIKE	IN	3.	3.	3.	2.	269.
BOONE	IN	0.	3.	5.	3.	267.
HAMILTON	IN	0.	3.	5.	3.	267.
MADISON	IN	0.	3.	5.	3.	267.
SHELBY	IN	0.	3.	5.	3.	267.
HARRISON	IN	2.	2.	4.	3.	267.
BRECKINRIDGE	KY	4.	1.	3.	3.	267.
UNION	KY	2.	2.	4.	3.	267.
CRITTENDEN	KY	2.	2.	4.	3.	267.
METCALFE	KY	4.	1.	3.	3.	267.
MONROE	KY	4.	1.	3.	3.	267.
OHIO	IN	3.	0.	4.	4.	265.
ALLEN	OH	0.	4.	5.	2.	264.
SHELBY	KY	2.	3.	4.	2.	264.
BATH	KY	4.	2.	3.	2.	264.
SWITZERLAND	IN	3.	1.	4.	3.	262.
GRANT	KY	3.	1.	4.	3.	262.
CRAWFORD	IN	2.	2.	2.	4.	262.
LYON	KY	2.	2.	2.	4.	262.
BARREN	KY	3.	1.	4.	3.	262.
MONTGOMERY	OH	0.	5.	5.	1.	261.
GREENE	OH	1.	3.	5.	2.	259.
MONROE	IN	2.	3.	2.	3.	259.
NELSON	KY	3.	2.	4.	2.	259.
PIKE	KY	4.	2.	1.	3.	259.
PERRY	KY	4.	2.	1.	3.	259.
ROWAN	KY	3.	2.	2.	3.	254.
LEE	KY	3.	2.	2.	3.	254.
BREATHITT	KY	3.	2.	2.	3.	254.
GREEN	KY	2.	1.	3.	4.	252.
JOHNSON	IN	0.	3.	4.	3.	249.
BUTLER	OH	0.	3.	4.	3.	249.
WARREN	OH	0.	3.	4.	3.	249.
CLAY	IN	0.	3.	4.	3.	249.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  12 PRIORITY ID            PAGE 4
                 WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY        STATE  HUMAN RESOURCE    TRANSPORTATION    ECOLOGICAL    PHYSICAL/CHEMICAL    WEIGHTED SUM

ORANGE         IN         2.                2                3.                3.               249.
GALLATIN       KY         2.                2                3.                3.               249.
ELLIOT         KY         4.                1                2.                3.               249.
MORGAN         KY         4.                1                2.                3.               249.
WOLFE          KY         4.                1                2.                3.               249.
CASEY          KY         4.                1                2.                3.               249.
OWSLEY         KY         4.                1                2.                3.               249.
CARTER         KY         4.                2                2.                2.               246.
JOHNSON        KY         4.                2                2.                2.               246.
FAYETTE        KY         0.                4                4.                2.               246.
OLDHAM         KY         1.                2                4.                3.               244.
ADAIR          KY         3.                1                3.                3.               244.
CUMBERLAND     KY         3.                1                3.                3.               244.
CLINTON        KY         3.                1                3.                3.               244.
MARTIN         IN         3.                2                3.                2.               241.
JESSAMINE      KY         1.                3                4.                2.               241.
CLERMONT       OH         0.                2                5.                3.               239.
MIAMI          OH         0.                3                5.                2.               236.
CLARK          OH         0.                3                5.                2.               236.
HENDRICKS      IN         0.                3                5.                2.               236.
HANCOCK        IN         0.                3                5.                2.               236.
PREBLE         OH         0.                3                5.                2.               236.
SCIOTO         OH         1.                3                2.                3.               236.
WOODFORD       KY         2.                2                4.                2.               236.
LIVINGSTON     KY         2.                2                4.                2.               236.
SCOTT          VA         4.                2                3.                1.               233.
TAZEWELL       VA         4.                2                3.                1.               233.
CAMP           KY         0.                3                3.                3.               231.
CLARK          IN         0.                3                3.                3.               231.
LARUE          KY         3.                1                4.                2.               231.
MERCER         KY         3.                1                4.                2.               231.
LAUREL         KY         2.                2                2.                3.               231.
BOYD           KY         2.                3                2.                2.               228.
BULLITT        KY         2.                3                2.                2.               228.
LEWIS          KY         3.                1                2.                3.               226.
PERRY          IN         3.                1                2.                3.               226.
ESTILL         KY         3.                1                2.                3.               226.
CLAY           KY         3.                1                2.                3.               226.
WAYNE          KY         3.                1                2.                3.               226.
MARION         KY         3.                2                2.                2.               223.
KNOTT          KY         5.                1                1.                2.               223.
TAYLOR         KY         2.                1                3.                3.               221.
RUSSELL        KY         2.                1                3.                3.               221.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  12 PRIORITY 10        PAGE 5
                  WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY              STATE   HUMAN RESOURCE       TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

SULLIVAN             IN           0.                  3.                   4.                   2.                218.
VANDERBURGH          IN           0.                  3.                   4.                   2.                218.
HENDERSON            KY           0.                  3.                   4.                   2.                218.
RUSSELL              VA           4.                  2.                   2.                   1.                215.
WARWICK              IN           1.                  2.                   4.                   2.                213.
LEE                  VA           3.                  2.                   3.                   1.                210.
KENTON               KY           0.                  3.                   0.                   4.                208.
SPENCER              KY           2.                  1.                   4.                   2.                208.
GARRARD              KY           2.                  1.                   4.                   2.                208.
BOONE                KY           0.                  1.                   3.                   4.                206.
EDMONSON             KY           0.                  1.                   3.                   4.                206.
MCCREARY             KY           3.                  2.                   1.                   2.                205.
BROWN                IN           2.                  1.                   2.                   3.                203.
MENATEE              KY           2.                  1.                   2.                   3.                203.
POWELL               KY           2.                  1.                   2.                   3.                203.
JACKSON              KY           2.                  1.                   2.                   3.                203.
MORGAN               IN           0.                  2.                   1.                   4.                198.
LETCHER              KY           4.                  2.                   1.                   1.                197.
FLOYD                IN           1.                  2.                   3.                   2.                195.
GREENUP              KY           3.                  1.                   2.                   2.                195.
LAWRENCE             KY           3.                  1.                   2.                   2.                195.
WHITLEY              KY           3.                  2.                   2.                   1.                192.
WISE                 VA           3.                  2.                   2.                   1.                192.
TRIGG                KY           1.                  1.                   2.                   3.                180.
MARTIN               KY           3.                  1.                   1.                   2.                177.
MAGOFFINE            KY           3.                  1.                   1.                   2.                177.
BUCHANAN             VA           3.                  2.                   1.                   1.                174.
HARLAN               KY           3.                  2.                   1.                   1.                174.
LESLIE               KY           4.                  1.                   1.                   1.                169.
DICKENSON            VA           2.                  2.                   2.                   1.                169.
BELL                 KY           2.                  2.                   2.                   1.                169.
TRIMBLE              KY           1.                  0.                   0.                   3.                116.
CARROLL              KY           2.                  0.                   0.                   2.                108.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 13 PRIORITY 1R

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
LIVINGSTON	IL	4.	3.	5.	5.	421.
VERMILLION	IL	3.	4.	5.	4.	395.
IROQUOIS	IL	4.	3.	5.	4.	390.
BENTON	IN	5.	3.	5.	3.	382.
GRUNDY	IL	2.	3.	5.	5.	375.
DODGE	WI	3.	3.	5.	4.	367.
OGLE	IL	3.	3.	5.	4.	367.
FULTON	IN	4.	3.	5.	3.	359.
COOK	IL	0.	5.	5.	4.	354.
DANE	WI	1.	3.	5.	5.	352.
NOBLE	IN	5.	3.	5.	2.	351.
DEKALB	IN	5.	3.	5.	2.	351.
COLUMBIA	WI	3.	3.	4.	4.	349.
KANKAKEE	IL	2.	4.	5.	3.	341.
FOUNTAIN	IN	3.	2.	5.	4.	339.
LAPORTE	IN	2.	5.	5.	2.	338.
ST. JOSEPH	IN	2.	5.	5.	2.	338.
WHITE	IN	3.	3.	5.	3.	336.
CASS	IN	3.	3.	5.	3.	336.
WELLS	IN	3.	3.	5.	3.	336.
FORD	IL	3.	3.	5.	3.	336.
WARREN	IN	3.	3.	5.	3.	336.
CLINTON	IN	3.	3.	5.	3.	336.
SAUK	WI	3.	2.	3.	5.	334.
PARKE	IN	3.	2.	3.	5.	334.
ELKHART	IN	3.	4.	5.	2.	333.
WHITLEY	IN	3.	4.	5.	2.	333.
JASPER	IN	4.	3.	5.	2.	328.
PULASKI	IN	4.	3.	5.	2.	328.
OZAUKEE	WI	0.	4.	5.	4.	326.
KENDALL	IL	1.	2.	5.	5.	324.
LAGRANGE	IN	5.	2.	5.	2.	323.
ALLEN	IN	0.	5.	5.	3.	323.
WILL	IL	1.	4.	5.	3.	318.
LASALLE	IL	2.	2.	5.	4.	316.
STARKE	IN	3.	4.	4.	2.	315.
WABASH	IN	2.	3.	5.	3.	313.
BLACKFORD	IN	3.	2.	5.	3.	308.
MONTGOMERY	IN	3.	2.	5.	3.	308.
GREEN	WI	3.	3.	5.	2.	305.
ADAMS	IN	3.	3.	5.	2.	305.
KANE	IL	0.	3.	5.	4.	298.
CHAMPAIGN	IL	0.	3.	5.	4.	298.

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SORTED WEIGHTED RANKIN  FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  13 PRIORITY 1R        PAGE 2
                  WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY              STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL     WEIGHTED SUM

KOSCIUSKC            IN           4.                  3.                  5.                   1.                297.
JEFFERSON            WI           2.                  3                   4.                   3.                295.
MILWAUKEE            WI           0.                  4.                  5.                   3.                295.
TIPPECANOE           IN           0.                  4.                  5.                   3.                295.
LAKE                 IN           0.                  5.                  5.                   2.                292.
WASHINGTON           WI           1.                  3.                  5.                   3.                290.
DEKALB               IL           1.                  3.                  5.                   3.                290.
HOWARD               IN           1.                  3.                  5.                   3.                290.
GRANT                IN           1.                  3.                  5.                   3.                290.
CARROLL              IN           3.                  3.                  4.                   2.                287.
MIAMI                IN           2.                  3.                  5.                   2.                282.
HUNTINGTON           IN           2.                  3.                  5.                   2.                282.
NEWTON               IN           3.                  2.                  5.                   2.                277.
LAKE                 IL           0.                  4.                  5.                   2.                264.
DE PAGE              IL           0.                  4.                  5.                   2.                264.
PORTER               IN           0.                  5.                  5.                   1.                261.
ROCK                 WI           2.                  3.                  5.                   1.                251.
VERMILLION           IN           0.                  3.                  4.                   3.                249.
BERRIEN              MI           1.                  3.                  4.                   2.                241.
BOONE                IL           0.                  2.                  5.                   3.                239.
KENOSHA              WI           0.                  3                   5.                   2.                236.
WIWINNEBAGO          IL           0.                  3.                  5.                   2.                236.
MCHENRY              IL           0.                  3.                  5.                   2.                236.
CASS                 MI           2.                  3.                  4.                   1.                233.
WAUKESHA             WI           0.                  3.                  4.                   2.                218.
RACINE               WI           0.                  3.                  4.                   2.                218.
WALWORTH             WI           2.                  2.                  4.                   1.                205.
MARSHALL             IN           0.                  3.                  5.                   1.                205.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 14 PRIORITY 1A
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
SHIAWASSEE	MI	5.	4.	5.	4.	441.
GRATIOT	MI	5.	2.	5.	5.	416.
ISABELLA	MI	5.	3.	4.	4.	395.
OSCEOLA	MI	4.	3.	4.	4.	372.
IONIA	MI	3.	3.	5.	4.	367.
LIVINGSTON	MI	5.	3.	4.	3.	364.
WILLIAMS	MI	4.	3.	5.	3.	359.
STUBEN	MI	5.	2.	5.	3.	354.
CLINTON	MI	1.	3.	5.	5.	352.
CLARE	MI	3.	3.	3.	4.	331.
HILLSDALE	MI	4.	3.	5.	2.	328.
DEFIANCE	MI	4.	3.	5.	2.	328.
GENESEE	MI	0.	4.	5.	4.	326.
MIDLAND	MI	4.	3.	3.	3.	323.
MECOSTA	MI	4.	2.	4.	3.	313.
MONTCALM	MI	4.	2.	4.	3.	313.
LENAWEE	MI	3.	3.	5.	2.	305.
MISSAUKEE	MI	3.	2.	3.	4.	303.
SAGINAW	MI	0.	4.	5.	3.	295.
HURON	MI	1.	2.	5.	4.	293.
WAYNE	MI	0.	5.	5.	2.	292.
SANILAC	MI	2.	2.	5.	3.	285.
OGEMAW	MI	3.	3.	2.	3.	282.
LAKE	MI	3.	3.	2.	3.	282.
SANDUSKY	MI	2.	3.	5.	2.	282.
PAULDING	MI	2.	3.	5.	2.	282.
EATON	MI	0.	3.	4.	4.	280.
INGHAM	MI	0.	3.	4.	4.	280.
BRANCH	MI	4.	3.	4.	1.	279.
KALKASKA	MI	4.	2.	2.	3.	277.
FULTON	MI	3.	3.	5.	1.	274.
WEXFORD	MI	3.	2.	3.	3.	272.
ROSCOMMON	MI	2.	3.	1.	4.	272.
TUSCOLA	MI	1.	3.	4.	3.	272.
LA PEER	MI	1.	3.	4.	3.	272.
NEWAYGO	MI	3.	3	3.	2.	269.
GLADWIN	MI	4.	1.	3.	3.	267.
CRAWFORD	MI	3.	3.	1.	3.	264.
ARENAC	MI	2.	3.	4.	2.	264.
HAY	MI	0.	4.	5.	2.	264.
OSCODA	MI	4.	1.	1.	4.	262.
HARRY	MI	3.	3.	4.	1.	256.
GRANDIRA VERSE	MI	1.	3.	3.	3.	254.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 14 PRIORITY 1A

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
MANISTEE	MI	1.	3.	3.	3.	254.
MASON	MI	1.	3.	3.	3.	254.
HENRY	MI	2.	3.	5.	1.	251.
ALPENA	MI	2.	2.	3.	3.	249.
JACKSON	MI	0.	3.	4.	3.	249.
WASHTENAW	MI	0.	3.	4.	3.	249.
LEE LANAU	MI	1.	2.	4.	3.	244.
KENT	MI	1.	3.	4.	2.	241.
ST CLAIR	MI	1.	3.	4.	2.	241.
CALHOUN	MI	1.	3.	4.	2.	241.
MONROE	MI	0.	3.	5.	2.	236.
WOOD	MI	0.	3.	5.	2.	236.
PUTNAM	MI	0.	3.	5.	2.	236.
VAN WERT	MI	0.	3.	5.	2.	236.
CHEBOYGAN	MI	2.	2.	2.	3.	231.
OTSEGO	MI	2.	2.	2.	3.	231.
ALCONA	MI	2.	2.	2.	3.	231.
IOSCO	MI	2.	2.	2.	3.	231.
EMMET	MI	1.	2.	3.	3.	226.
OCEANA	MI	1.	2.	3.	3.	226.
MUSKEGON	MI	0.	3.	4.	2.	218.
ALLEGAN	MI	2.	3.	3.	1.	215.
OTTAWA	MI	1.	3.	4.	1.	210.
VANBUREN	MI	1.	3.	4.	1.	210.
KALAMAZOO	MI	1.	3.	4.	1.	210.
OTTAWA	MI	1.	3.	4.	1.	210.
PRESQUE ISLE	MI	1.	2.	2.	3.	208.
OAKLAND	MI	0.	3.	5.	1.	205.
ST. JOSEPH	MI	2.	2.	4.	1.	205.
LUCAS	MI	0.	3.	5.	1.	205.
CHARLEVOIX	MI	1.	2.	3.	2.	195.
ANTRIM	MI	1.	2.	3.	2.	195.
BENZIE	MI	1.	2.	3.	2.	195.
MACOMB	MI	0.	3.	4.	1.	187.
MONTMORENCY	MI	2.	1.	1.	3.	185.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 15 PRIORITY 6A PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
MORTON	ND	5.	2.	4.	5.	398.
SPINK	SD	5.	2.	4.	5.	398.
WALSH	ND	4.	2.	4.	5.	375.
GRAND FORKS	ND	4.	2.	4.	5.	375.
STEELE	ND	4.	2.	4.	5.	375.
TRAILL	ND	4.	2.	4.	5.	375.
OLIVER	ND	4.	2.	4.	5.	375.
BURLEIGH	ND	4.	2.	4.	5.	375.
BARNES	ND	4.	2.	4.	5.	375.
BILLINGS	ND	4.	2.	4.	5.	375.
RANSON	ND	4.	2.	4.	5.	375.
BROWN	SD	5.	2.	4.	4.	367.
STARK	ND	4.	2.	3.	5.	357.
MARSHALL	SD	4.	2.	3.	5.	357.
MERCER	ND	3.	2.	4.	5.	352.
FREEBORN	MN	4.	4.	3.	3.	351.
WILLIAMS	ND	4.	1.	4.	5.	347.
BENSON	ND	4.	1.	4.	5.	347.
EDDY	ND	4.	1.	4.	5.	347.
DEMMONS	ND	4.	1.	4.	5.	347.
PERKINS	SD	4.	1.	4.	5.	347.
GRIGGS	ND	4.	2.	4.	4.	344.
KIDDER	ND	4.	2.	4.	4.	344.
STUTSMAN	ND	4.	2.	4.	4.	344.
DICKEY	ND	4.	2.	4.	4.	344.
SARGENT	ND	4.	2.	4.	4.	344.
RICHLAND	ND	4.	2.	4.	4.	344.
WILKIN	MN	4.	2.	4.	4.	344.
LINCOLN	MN	4.	2.	4.	4.	344.
MURRAY	MN	4.	2.	4.	4.	344.
CHIPPEWA	MN	4.	3.	4.	3.	341.
ROCK	MN	5.	2.	4.	3.	336.
HARDING	SD	4.	1.	5.	4.	334.
CASS	ND	2.	2.	4.	5.	329.
GRANT	ND	4.	1.	3.	5.	329.
ADAMS	ND	4.	1.	3.	5.	329.
MARSHALL	MN	4.	2.	3.	4.	326.
RED LAKE	MN	4.	2.	3.	4.	326.
POLK	MN	4.	2.	3.	4.	326.
ORMAN	MN	4.	2.	3.	4.	326.
LAC QUI PERLE	SD	4.	2.	3.	4.	326.
CLARK	SD	4.	2.	3.	4.	326.
DEUEL	SD	4.	2.	3.	4.	326.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  15 PRIORITY 6A          PAGE 2
                       WEIGHTS   PHYSICAL =    31.   TRANS =    28.   HUMAN =    23.   ECOLOGY =    18.

COUNTY                STATE   HUMAN RESOURCE       TRANSPORTATION        ECOLOGICAL         PHYSICAL/CHEMICAL     WEIGHTED SUM

YELLOW MEDICINE        MN          4.                    2.                  3.                    4.                  326.
JACKSON                MN          4.                    2.                  3.                    4.                  326.
DUNN                   ND          3.                    1.                  4.                    5.                  324.
CORSON                 SD          3.                    1.                  4.                    5.                  324.
STEELE                 MN          4.                    3.                  3.                    3.                  323.
DODGE                  MN          4.                    3.                  3.                    3.                  323.
TRAVERSE               MN          3.                    2.                  4.                    4.                  321.
BIG STONE              MN          3.                    2.                  4.                    4.                  321.
NOBLES                 MN          5.                    2.                  3.                    3.                  318.
MOUNTRAIL              ND          4.                    1.                  4.                    4.                  316.
WARD                   ND          4.                    1.                  4.                    4.                  316.
MCHENRY                ND          4.                    1.                  4.                    4.                  316.
PIERCE                 ND          4.                    1.                  4.                    4.                  316.
RAMSEY                 ND          4.                    1.                  4.                    4.                  316.
MCKENZIE               ND          4.                    1.                  4.                    4.                  316.
WELLS                  ND          4.                    1.                  4.                    4.                  316.
FOSTER                 ND          4.                    1.                  4.                    4.                  316.
GOLDEN VALLEY          ND          4.                    1.                  4.                    4.                  316.
SLOPE                  ND          4.                    1.                  4.                    4.                  316.
LOGAN                  ND          4.                    1.                  4.                    4.                  316.
LA MOURE               ND          4.                    1.                  4.                    4.                  316.
MCINTOSH               ND          4.                    1.                  4.                    4.                  316.
BOWMAN                 ND          4.                    1.                  4.                    4.                  316.
CAMPBELL               SD          4.                    1.                  4.                    4.                  316.
MCPHERSON              SD          4.                    1.                  4.                    4.                  316.
POTTER                 SD          4.                    1.                  4.                    4.                  316.
RAMSEY                 MN          1.                    5.                  5.                    2.                  315.
NELSON                 ND          4.                    2.                  4.                    3.                  313.
STEVENS                MN          4.                    2.                  4.                    3.                  313.
SWIFT                  MN          4.                    2.                  4.                    3.                  313.
CODINGTON              SD          4.                    2.                  4.                    3.                  313.
HAMLIN                 SD          4.                    2.                  4.                    3.                  313.
RENVILLE               MN          4.                    2.                  4.                    3.                  313.
MARTIN                 MN          4.                    2.                  4.                    3.                  313.
FARIBAULT              MN          4.                    2.                  4.                    3.                  313.
ROBERTS                SD          2.                    2.                  3.                    5.                  311.
BUFFALO                WI          4.                    2.                  2.                    4.                  308.
WALWORTH               SD          3.                    1.                  3.                    5.                  306.
BENTON                 MN          4.                    3.                  2.                    3.                  305.
OTTER TAIL             MN          3.                    2.                  3.                    4.                  303.
GRANT                  SD          3.                    2.                  3.                    4.                  303.
DEWEY                  SD          2.                    1.                  4.                    5.                  301.
JACKSON                WI          5.                    2.                  2.                    3.                  300.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  15 PRIORITY 6A        PAGE 3
                     WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE   HUMAN RESOURCE    TRANSPORTATION    ECOLOGICAL    PHYSICAL/CHEMICAL    WEIGHTED SUM

HETTINGER          ND          4.               1.               3.               4.                 298.
EDMUNDS            SD          4.               1.               3.               4.                 298.
PENNINGTON         MN          4.               2.               3.               3.                 295.
GRANT              MN          4.               2.               3.               3.                 295.
DOUGLAS            MN          4.               2.               3.               3.                 295.
POPE               MN          4.               2.               3.               3.                 295.
DAY                SD          4.               2.               3.               3.                 295.
LYON               MN          4.               2.               3.               3.                 295.
PIPESTONE          MN          4.               2.               3.               3.                 295.
COTTONWOOD         MN          4.               2.               3.               3.                 295.
WATONWAN           MN          4.               2.               3.               3.                 295.
WASECA             MN          4.               2.               3.               3.                 295.
MOWER              MN          4.               2.               3.               3.                 295.
STEARNS            MN          4.               3.               3.               2.                 292.
KANDIYOHI          MN          4.               3.               3.               2.                 292.
ZIEBACH            SD          2.               1.               5.               4.                 288.
SHERIDAN           ND          4.               1.               4.               3.                 285.
WADENA             MN          3.               2.               2.               4.                 285.
FAULK              SD          4.               1.               4.               3.                 285.
KANABEC            MN          3.               3.               2.               3.                 282.
RUSK               WI          3.               3.               2.               3.                 282.
CHIPPEWA           WI          3.               3.               2.               3.                 282.
CLAY               MN          2.               2.               3.               4.                 280.
TOWNER             ND          1.               1.               4.               5.                 278.
ST. CROIX          WI          2.               3.               3.               3.                 277.
CLARK              WI          4.               2.               2.               3.                 277.
TREMPEALEAU        WI          4.               2.               2.               3.                 277.
LA CROSSE          WI          4.               2.               2.               3.                 277.
ADAMS              WI          4.               2.               2.               3.                 277.
WAUSHARA           WI          4.               2.               2.               3.                 277.
CAVALIER           ND          1.               2.               4.               4.                 275.
PEMBINA            ND          1.               2.               4.               4.                 275.
TODD               MN          4.               3.               2.               2.                 274.
MCLEOD             MN          3.               2.               3.               3.                 272.
REDWOOD            MN          3.               2.               3.               3.                 272.
WABASHA            MN          3.               2.               3.               3.                 272.
OLMSTED            MN          3.               2.               3.               3.                 272.
WINONA             MN          3.               2.               3.               3.                 272.
FILLMORE           MN          3.               2.               3.               3.                 272.
HOUSTON            MN          3.               2.               3.               3.                 272.
SIOUX              ND          2.               1.               4.               4.                 270.
SHERBURNE          MN          3.               3.               3.               2.                 269.
MONROE             WI          5.               2.               2.               2.                 269.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 15 PRIORITY 6A PAGE 4
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 16.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
HENNEPIN	MN	1.	5.	4.	1.	266.
ONEIDA	WI	3.	3.	1.	3.	264.
MEEKER	MN	4.	2.	3.	2.	264.
NICOLLEY	MN	4.	2.	3.	2.	264.
BROWN	MN	4.	2.	3.	2.	264.
BLUE EARTH	MN	4.	2.	3.	2.	264.
MCCLEAN	ND	3.	1.	4.	3.	262.
WINNEBAGO	WI	4.	3.	3.	1.	261.
KITTSON	MN	1.	2.	3.	4.	257.
CLEAR WATER	MN	3.	2.	2.	3.	254.
MORRISON	MN	3.	2.	2.	3.	254.
LINCOLN	WI	3.	2.	2.	3.	254.
DUNN	WI	3.	2.	2.	3.	254.
PIERCE	WI	3.	2.	2.	3.	254.
PEPIN	WI	3.	2.	2.	3.	254.
PINE	MN	3.	3.	2.	2.	251.
BARRON	WI	3.	3.	2.	2.	251.
MARATHON	WI	3.	3.	2.	2.	251.
GOODHUE	MN	2.	2.	3.	3.	249.
DIVIDE	ND	1.	1.	4.	4.	247.
BURKE	ND	1.	1.	4.	4.	247.
RENVILLE	ND	1.	1.	4.	4.	247.
BOTTINEAU	ND	1.	1.	4.	4.	247.
ROLETTE	ND	1.	1.	4.	4.	247.
WRIGHT	MN	2.	3.	3.	2.	246.
PORTAGE	WI	4.	2.	2.	2.	246.
WAUPACA	WI	4.	2.	2.	2.	246.
JUNEAU	WI	4.	2.	2.	2.	246.
WOOD	WI	4.	3.	2.	1.	243.
ANOKA	MN	1.	3.	4.	2.	241.
SHAWANO	WI	3.	2.	3.	2.	241.
SIBLEY	MN	3.	2.	3.	2.	241.
LESUER	MN	3.	2.	3.	2.	241.
MARQUETT	WI	3.	2.	3.	2.	241.
GREEN LAKE	WI	3.	2.	3.	2.	241.
FOND DU LAC	WI	3.	3.	3.	1.	238.
HUBBARD	MN	3.	2.	1.	3.	236.
CROWNING	MN	3.	2.	1.	3.	236.
FLORENCE	WI	3.	2.	1.	3.	236.
DICKINSON	MI	3.	2.	1.	3.	236.
SAWYER	WI	3.	2.	1.	3.	236.
PRICE	WI	3.	2.	1.	3.	236.
LANGLADE	WI	3.	2.	1.	3.	236.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  15 PRIORITY 6A        PAGE 5
                  WEIGHTS   PHYSICAL =    31.   TRANS =    28.   HUMAN =    23.   ECOLOGY =    18.

COUNTY          STATE   HUMAN RESOURCE   TRANSPORTATION   ECOLOGICAL   PHYSICAL/CHEMICAL   WEIGHTED SUM

WASHBURN         WI          3.               3.               1.              2.               233.
MANITOWOC        WI          2.               3.               4.              1.               233.
BECKER           MN          2.               2.               2.              3.               231.
OCONTO           WI          2.               2.               2.              3.               231.
MILLELACS        MN          3.               2.               2.              2.               223.
BURNETT          WI          3.               2.               2.              2.               223.
MARINETTE        WI          3.               2.               2.              2.               223.
ISANTI           MN          3.               2.               2.              2.               223.
TAYLOR           WI          3.               2.               2.              2.               223.
EAU CLAIRE       WI          3.               2.               2.              2.               223.
DAKOTA           MN          1.               3.               3.              2.               223.
CARVER           MN          2.               2.               3.              2.               218.
RICE             MN          2.               2.               3.              2.               218.
SHEBOYGAN        WI          2.               2.               3.              2.               218.
ST. LOUIS        MN          1.               4.               1.              2.               215.
DELTA            MI          2.               2.               1.              3.               213.
BROWN            WI          1.               2.               4.              2.               213.
CARLTON          MN          2.               3.               1.              2.               210.
OUTAGAMIE        WI          3.               2.               3.              1.               210.
ROSEAU           MN          1.               2.               2.              3.               208.
DOUGLAS          WI          1.               3.               2.              2.               205.
FOREST           WI          3.               2.               1.              2.               205.
MENOMINEE        MI          3.               2.               1.              2.               205.
KEWAUNEE         WI          2.               2.               4.              1.               205.
CALUMET          WI          2.               2.               4.              1.               205.
MAHNOMEN         MN          2.               1.               2.              3.               203.
CHISAGO          MN          2.               2.               2.              2.               200.
POLK             WI          2.               2.               2.              2.               200.
ITASCA           MN          1.               2.               1.              3.               190.
LAKE             MN          1.               2.               1.              3.               190.
CASS             MN          1.               2.               1.              3.               190.
BAYFIELD         WI          1.               2.               1.              3.               190.
BELTRAMI         MN          1.               3.               1.              2.               187.
SCOTT            MN          2.               2.               3.              1.               187.
BARAGA           MI          2.               2.               1.              2.               182.
MARQUETTE        MI          2.               2.               1.              2.               182.
SCHOOLCRAFT      MI          2.               2.               1.              2.               182.
MACKINAW         MI          2.               2.               1.              2.               182.
WASHINGTON       MN          1.               2.               3.              1.               164.
ONTONOGON        MI          1.               2.               1.              2.               159.
HOUGHTON         MI          1.               2.               1.              2.               159.
ALGER            MI          1.               2.               1.              2.               159.
LUCE             MI          1.               2.               1.              2.               159.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  15 PRIORITY 5A          PAGE 6
                  WEIGHTS   PHYSICAL =    31.    TRANS =    28.    HUMAN =    23.    ECOLOGY =    18.

COUNTY                 STATE   HUMAN RESOURCE      TRANSPORTATION       ECOLOGICAL       PHYSICAL/CHEMICAL     WEIGHTED SUM

CHIPPEWA                MI           1.                  2.                 1.                 2.                  159.
AITKIN                  MN           1.                  2.                 1.                 2.                  159.
ASHLAND                 WI           1.                  2.                 1.                 2.                  159.
IRON                    WI           1.                  2.                 1.                 2.                  159.
GOGEBIC                 MI           1.                  2.                 1.                 2.                  159.
VILAS                   WI           1.                  2.                 1.                 2.                  159.
IRON                    MI           1.                  2.                 1.                 2.                  159.
KOOCSHING               MN           1.                  2.                 0.                 2.                  141.
COOK                    MN           0.                  1.                 1.                 3.                  139.
LAKE OF THE WOODS       MN           0.                  2.                 1.                 2.                  136.
KEWEENAW                MI           0.                  1.                 1.                 1.                   77.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  16 PRIORITY 6B          PAGE 1
                   WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY               STATE   HUMAN RESOURCE      TRANSPORTATION      ECOLOGICAL      PHYSICAL/CHEMICAL     WEIGHTED SUM

HOWARD                IA          4.                  4.                 5.                 5.                 449.
VERNON                WI          5.                  4.                 3.                 5.                 436.
MITCHELL              IA          4.                  4.                 4.                 5.                 431.
WORTH                 IA          3.                  4.                 5.                 5.                 426.
WINNESHIEK            IA          4.                  4.                 4.                 4.                 400.
BUREAU                IL          3.                  3.                 5.                 5.                 398.
CHARITON              MO          5.                  2.                 4.                 5.                 398.
MARSHALL              IA          3.                  4.                 5.                 4.                 395.
LUCAS                 IA          4.                  2.                 5.                 5.                 393.
FRANKLIN              WI          4.                  3.                 5.                 4.                 390.
KNOX                  IL          3.                  4.                 4.                 4.                 377.
CHICKASAW             WI          4.                  2.                 4.                 5.                 375.
MARION                IA          4.                  2.                 4.                 5.                 375.
HENDERSON             IL          4.                  2.                 4.                 5.                 375.
VANBUREN              IA          4.                  2.                 4.                 5.                 375.
MERCER                MO          4.                  2.                 4.                 5.                 375.
JEFFERSON             IA          4.                  3.                 4.                 4.                 372.
MCDONOUGH             IL          4.                  3.                 4.                 4.                 372.
MACON                 MO          4.                  3.                 4.                 4.                 372.
FLOYD                 WI          3.                  2.                 5.                 5.                 370.
GRUNDY                IA          3.                  2.                 5.                 5.                 370.
CERRO GORDO           WI          3.                  3.                 5.                 4.                 367.
CRAWFORD              WI          4.                  4.                 2.                 4.                 364.
LINN                  MO          5.                  3.                 4.                 3.                 364.
FAYETTE               WI          4.                  2.                 5.                 4.                 362.
TAMA                  IA          4.                  2.                 5.                 4.                 362.
ALLAMAKEE             IA          3.                  4.                 3.                 4.                 359.
IOWA                  WI          4.                  2.                 3.                 5.                 357.
DAVIS                 IA          4.                  2.                 3.                 5.                 357.
PUTNAM                IL          3.                  2.                 4.                 5.                 352.
WARREN                IL          3.                  2.                 4.                 5.                 352.
APPANOOSE             IA          3.                  2.                 4.                 5.                 352.
CLAYTON               WI          4.                  2.                 4.                 4.                 344.
HARDIN                IA          4.                  2.                 4.                 4.                 344.
JACKSON               IA          4.                  2.                 4.                 4.                 344.
MAHASKA               IA          4.                  2.                 4.                 4.                 344.
KEOKUK                IA          4.                  2.                 4.                 4.                 344.
WASHINGTON            IA          4.                  2.                 4.                 4.                 344.
LOUISA                IA          4.                  2.                 4.                 4.                 344.
HENRY                 IA          4.                  2.                 4.                 4.                 344.
WAYNE                 IA          4.                  2.                 4.                 4.                 344.
PUTNAM                MO          4.                  2.                 4.                 4.                 344.
SCHUYLER              MO          4.                  2.                 4.                 4.                 344.
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SORTED WEIGHTED RANKIN FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 16 PRIORITY 6B PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
SCOTLAND	MO	4.	2.	4.	4.	344.
GRUNDY	MO	4.	2.	4.	4.	344.
SULLIVAN	MO	4.	2.	4.	4.	344.
ADAIR	MO	4.	2.	4.	4.	344.
LEE	IA	4.	3.	4.	3.	341.
BUCHANAN	IA	3.	2.	5.	4.	339.
BENTON	IA	3.	2.	5.	4.	339.
JASPER	IA	3.	2.	5.	4.	339.
POWESHIEK	IA	3.	2.	5.	4.	339.
IOWA	IA	3.	2.	5.	4.	339.
LEE	IL	3.	3.	5.	3.	336.
RICHLAND	WI	4.	1.	3.	5.	329.
MONROE	IA	4.	2.	3.	4.	326.
BUTLER	WI	3.	2.	4.	4.	321.
BREMER	WI	3.	2.	4.	4.	321.
LAFAYETTE	WI	3.	2.	4.	4.	321.
CARROLL	IL	3.	2.	4.	4.	321.
MERCER	IL	3.	2.	4.	4.	321.
STARK	IL	3.	2.	4.	4.	321.
LINN	IA	1.	4.	5.	3.	318.
CLINTON	IA	3.	3.	4.	3.	318.
WAPELLO	IA	3.	3.	4.	3.	318.
DES MOINES	IA	3.	3.	4.	3.	318.
FULTON	IL	3.	3.	4.	3.	318.
GRANT	WI	3.	2.	2.	5.	316.
HENRY	IL	2.	2.	5.	4.	316.
CLARK	MO	4.	2.	4.	3.	313.
HANCOCK	IL	4.	2.	4.	3.	313.
SCHUYLER	IL	4.	2.	4.	3.	313.
BROWN	IL	4.	2.	4.	3.	313.
SHELBY	MO	4.	2.	4.	3.	313.
DELAWARE	IA	3.	2.	5.	3.	308.
STEPHENSON	IL	3.	3.	5.	2.	305.
WHITESIDE	IL	3.	3.	5.	2.	305.
JO DAVIESS	IL	3.	2.	3.	4.	303.
DUBUQUE	IA	2.	3.	4.	3.	295.
LEWIS	MO	4.	2.	3.	3.	295.
BLACK HAWK	IA	1.	3.	5.	3.	290.
JONES	IA	3.	2.	4.	3.	290.
JOHNSON	IA	3.	2.	4.	3.	290.
MARSHALL	IL	3.	2.	4.	3.	290.
KNOX	MO	3.	2.	4.	3.	290.
RANDOLPH	MO	3.	2.	4.	3.	290.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  16 PRIORITY 6B          PAGE 3
                     WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =    23.   ECOLOGY =   18.

COUNTY             STATE   HUMAN RESOURCE       TRANSPORTATION           ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

ADAMS                IL          3.                  3.                       4.                   2.                287.
CEDAR                IA          3.                  1.                       5.                   3.                280.
MONROE               MO          2.                  2.                       4.                   3.                267.
MUSCATINE            IA          3.                  2.                       4.                   2.                259.
MARION               MO          4.                  2.                       4.                   1.                251.
PEORIA               IL          1.                  3.                       4.                   2.                241.
SCOTT                IA          1.                  2.                       5.                   2.                231.
WOODFORD             IL          1.                  2.                       4.                   2.                213.
ROCK ISLAND          IL          1.                  2.                       4.                   1.                182.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 17 PRIORITY 6C PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
AUDRAIN	MO	4.	3.	5.	4.	390.
MOULTRIE	IL	3.	3.	4.	5.	380.
PLATT	IL	2.	3.	5.	5.	375.
MARION	IL	3.	5.	4.	3.	374.
MONTGOMERY	IL	3.	5.	5.	2.	361.
SHELBY	IL	3.	2.	4.	5.	352.
MCLEAN	IL	1.	4.	5.	4.	349.
MACON	IL	1.	4.	5.	4.	349.
COOPER	MO	3.	3.	4.	4.	349.
LACLEDE	MO	5.	2.	3.	4.	349.
SANGAMON	IL	1.	5.	5.	3.	346.
PIKE	IL	4.	2.	4.	4.	344.
RALLS	MO	4.	2.	4.	4.	344.
PIKE	MO	4.	2.	4.	4.	344.
CALLAWAY	MO	4.	2.	4.	4.	344.
FAYETTE	IL	4.	3.	4.	3.	341.
CHRISTIAN	IL	3.	3.	5.	3.	336.
CLAY	IL	4.	2.	5.	3.	331.
MONTGOMERY	MO	4.	2.	3.	4.	326.
MORGAN	MO	4.	2.	3.	4.	326.
SCOTT	IL	3.	2.	4.	4.	321.
LINCOLN	MO	3.	2.	4.	4.	321.
GREENE	IL	3.	3.	4.	3.	318.
EFFINGHAM	IL	3.	3.	4.	3.	318.
PERRY	IL	3.	3.	4.	3.	318.
LOGAN	IL	2.	3.	5.	3.	313.
DE WITT	IL	2.	3.	5.	3.	313.
MORGAN	IL	2.	3.	5.	3.	313.
WAYNE	IL	4.	2.	4.	3.	313.
HAMILTON	IL	4.	2.	4.	3.	313.
WABASH	IL	4.	3.	4.	2.	310.
WHITE	IL	4.	3.	4.	2.	310.
OSAGE	MO	4.	2.	2.	4.	308.
MADISON	MO	3.	2.	3.	4.	303.
BOLLINGER	MO	3.	2.	3.	4.	303.
OREGON	MO	3.	2.	3.	4.	303.
DALLAS	MO	4.	1.	3.	4.	298.
MADISON	IL	1.	5.	4.	2.	297.
JERSEY	IL	2.	3.	4.	3.	295.
EDWARD	IL	4.	2.	3.	3.	295.
CASS	IL	3.	2.	4.	3.	290.
HOWARD	MO	3.	2.	4.	3.	290.
BOONE	MO	3.	2.	4.	3.	290.

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SORTED WEIGHTED RANKING FO  HAZARDOUS WASTE PROCESSING SITES FOR REGION  17 PRIORITY OC          PAGE 1
                     WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY               STATE   HUMAN RESOURCE      TRANSPORTATION       ECOLOGICAL      PHYSICAL/CHEMICAL    WEIGHTED SUM

AUDRAIN               MO          4.                  3.                  5.                  4.              390.
MOULTRIE              IL          3.                  3.                  4.                  5.              380.
PLATT                 IL          2.                  3.                  5.                  5.              375.
MARION                IL          3.                  5.                  4.                  3.              374.
MONTGOMERY            IL          3.                  5.                  5.                  2.              361.
SHELBY                IL          3.                  2.                  4.                  5.              352.
MCLEAN                IL          1.                  4.                  5.                  4.              349.
MACON                 IL          1.                  4.                  5.                  4.              349.
COOPER                MO          3.                  3.                  4.                  4.              349.
LACLEDE               MO          5.                  2.                  3.                  4.              349.
SANGAMON              IL          1.                  5.                  5.                  3.              346.
PIKE                  IL          4.                  2.                  4.                  4.              344.
RALLS                 MO          4.                  2.                  4.                  4.              344.
PIKE                  MO          4.                  2.                  4.                  4.              344.
CALLAWAY              MO          4.                  2.                  4.                  4.              344.
FAYETTE               IL          4.                  3.                  4.                  3.              341.
CHRISTIAN             IL          3.                  3.                  5.                  3.              336.
CLAY                  IL          4.                  2.                  5.                  3.              331.
MONTGOMERY            MO          4.                  2.                  3.                  4.              326.
MORGAN                MO          4.                  2.                  3.                  4.              326.
SCOTT                 IL          3.                  2.                  4.                  4.              321.
LINCOLN               MO          3.                  2.                  4.                  4.              321.
GREENE                IL          3.                  3.                  4.                  3.              318.
EFFINGHAM             IL          3.                  3.                  4.                  3.              318.
PERRY                 IL          3.                  3.                  4.                  3.              318.
LOGAN                 IL          2.                  3.                  5.                  3.              313.
DE WITT               IL          2.                  3.                  5.                  3.              313.
MORGAN                IL          2.                  3.                  5.                  3.              313.
WAYNE                 IL          4.                  2.                  4.                  3.              313.
HAMILTON              IL          4.                  2.                  4.                  3.              313.
WABASH                IL          4.                  3.                  4.                  2.              310.
WHITE                 IL          4.                  3.                  4.                  2.              310.
OSAGE                 MO          4.                  2.                  2.                  4.              308.
MADISON               MO          3.                  2.                  3.                  4.              303.
BOLLINGER             MO          3.                  2.                  3.                  4.              303.
OREGON                MO          3.                  2.                  3.                  4.              303.
DALLAS                MO          4.                  1.                  3.                  4.              298.
MADISON               IL          1.                  5.                  4.                  2.              297.
JERSEY                IL          2.                  3.                  4.                  3.              295.
EDWARD                IL          4.                  2.                  3.                  3.              295.
CASS                  IL          3.                  2.                  4.                  3.              290.
HOWARD                MO          3.                  2.                  4.                  3.              290.
BOONE                 MO          3.                  2.                  4.                  3.              290.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 17 PRIORITY SC
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
MONITEAU	MO	3.	2.	4.	3.	290.
MACOUPIN	IL	3.	3.	4.	2.	287.
BOND	IL	3.	3.	4.	2.	287.
CLINTON	IL	3.	3.	4.	2.	287.
WASHINGTON	IL	3.	3.	4.	2.	287.
FEFFERSON	IL	3.	3.	4.	2.	287.
RANDOLPH	IL	3.	3.	4.	2.	287.
MENARD	IL	2.	2.	5.	3.	285.
MILLER	MO	3.	2.	2.	4.	285.
WAYNE	MO	3.	2.	2.	4.	285.
CAPE GIRARDEAU	MO	4.	2.	4.	2.	282.
STODDARD	MO	4.	2.	4.	2.	282.
DENT	MO	4.	1.	2.	4.	280.
MARIES	MO	4.	2.	2.	3.	277.
PULASKI	MO	4.	2.	2.	3.	277.
NEW MADRID	MO	3.	2.	5.	2.	277.
RIPLEY	MO	3.	1.	3.	4.	275.
WARREN	MO	3.	2.	3.	3.	272.
COLE	MO	3.	2.	3.	3.	272.
GASCONADE	MO	3.	2.	3.	3.	272.
WEBSTER	MO	3.	2.	3.	3.	272.
ST. LOUIS	MO	1.	4.	4.	2.	269.
SAINT CLAIR	IL	1.	4.	4.	2.	269.
FRANKLIN	IL	3.	3.	3.	2.	269.
GREENE	MO	1.	4.	4.	2.	269.
TAZEWELL	IL	0.	3.	5.	3.	267.
MONROE	IL	2.	3.	4.	2.	264.
PERRY	MO	4.	2.	3.	2.	264.
GALLATIN	IL	4.	2.	3.	2.	264.
BUTLER	MO	4.	2.	3.	2.	264.
ST. LOUIS (CITY)	MO	0.	5.	5.	1.	261.
MASON	IL	1.	3.	5.	2.	259.
ST. CHARLES	MO	1.	3.	3.	3.	254.
CRAWFORD	MO	3.	2.	2.	3.	254.
IRON	MO	3.	2.	2.	3.	254.
WRIGHT	MO	3.	2.	2.	3.	254.
HOWELL	MO	3.	2.	2.	3.	254.
TEXAS	MO	4.	1.	2.	3.	249.
PHELPS	MO	4.	2.	2.	2.	246.
WASHINGTON	MO	4.	2.	2.	2.	246.
SCOTT	MO	3.	2.	5.	1.	246.
STE. GENEVIEVE	MO	3.	2.	3.	2.	241.
HARDIN	IL	2.	1.	4.	3.	239.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 17 PRIORITY 6C          PAGE 3
                    WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY               STATE  HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

  MASSAC              IL          4.                2.                   3.                  1.                233.
  PULASKI             IL          4.                2.                   3.                  1.                233.
  SHANNON             MO          2.                2.                   2.                  3.                231.
  CARTER              MO          2.                2.                   2.                  3.                231.
  TANEY               MO          2.                2.                   2.                  3.                231.
  WILLIAMSON          IL          3.                2.                   4.                  1.                228.
  SALINE              IL          3.                2.                   4.                  1.                228.
  JOHNSON             IL          3.                2.                   4.                  1.                228.
  MISSISSIPPI         MO          3.                2.                   4.                  1.                228.
  CAMDEN              MO          3.                1.                   2.                  3.                226.
  REYNOLDS            MO          3.                1.                   2.                  3.                226.
  DOUGLAS             MO          3.                1.                   2.                  3.                226.
  FRANKLIN            MO          1.                3.                   3.                  2.                223.
  JEFFERSON           MO          1.                3.                   3.                  2.                223.
  ST. FRANCIOS        MO          3.                2.                   2.                  2.                223.
  POPE                IL          2.                2.                   3.                  2.                218.
  CHRISTIAN           MO          3.                1.                   3.                  2.                213.
  JACKSON             IL          3.                2.                   3.                  1.                210.
  UNION               IL          3.                2.                   3.                  1.                210.
  OZARK               MO          2.                1.                   2.                  3.                203.
  CALHOUN             IL          3.                1.                   0.                  3.                190.
  ALEX                IL          2.                2.                   3.                  1.                187.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  18 PRIORITY 8          PAGE 1
                   WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY           STATE   HUMAN RESOURCE     TRANSPORTATION      ECOLOGICAL      PHYSICAL/CHEMICAL    WEIGHTED SUM

GIBSON             TN          4.                 3.                5.                 4.                 390.
UNION              MS          4.                 3.                3.                 5.                 385.
HARDEMAN           TN          5.                 2.                3.                 5.                 380.
GRAVES             KY          5.                 2.                4.                 4.                 367.
HAYWOOD            TN          4.                 3.                2.                 5.                 367.
CROCKETT           TN          4.                 2.                5.                 4.                 362.
FAYETTE            TN          3.                 3.                3.                 5.                 362.
MARSHALL           MS          3.                 3.                3.                 5.                 362.
MADISON            TN          3.                 4.                3.                 4.                 359.
WEAKLEY            TN          4.                 2.                3.                 5.                 357.
TIPPAH             MS          4.                 2.                3.                 5.                 357.
LAFAYETTE          MS          4.                 2.                3.                 5.                 357.
CARROLL            TN          4.                 2.                4.                 4.                 344.
NOXUBEE            MS          4.                 2.                4.                 4.                 344.
LAWRENCE           AR          4.                 3.                4.                 3.                 341.
CHOCTAW            MS          4.                 2.                2.                 5.                 339.
MONTGOMERY         MS          5.                 2.                2.                 4.                 331.
HENDERSON          TN          4.                 2.                3.                 4.                 326.
CHESTER            TN          4.                 2.                3.                 4.                 326.
MCNAIRY            TN          4.                 2.                3.                 4.                 326.
PRENTISS           MS          4.                 2.                3.                 4.                 326.
PONTOLOC           MS          4.                 2.                3.                 4.                 326.
CHICKASAW          MS          4.                 2.                3.                 4.                 326.
ALCORN             MS          4.                 2.                3.                 4.                 326.
CLAY               MS          4.                 3.                3.                 3.                 323.
CRAIGHEAD          AR          3.                 3.                3.                 3.                 323.
ST. FRANCIS        AR          3.                 3.                4.                 3.                 318.
MONROE             AR          3.                 3.                4.                 3.                 318.
BENTON             MS          3.                 2.                2.                 5.                 316.
CLAY               AR          4.                 2.                4.                 3.                 313.
LEE                MS          4.                 2.                4.                 3.                 313.
WEBSTER            MS          4.                 1.                2.                 5.                 311.
TISHOMINGO         MS          4.                 2.                2.                 4.                 308.
YALOBUSHA          MS          4.                 2.                2.                 4.                 308.
WINSTON            MS          4.                 2.                2.                 4.                 308.
SHELBY             TN          0.                 5.                4.                 3.                 305.
OBION              TN          3.                 2.                3.                 4.                 303.
HENRY              TN          3.                 2.                3.                 4.                 303.
CALHOUN            MS          5.                 1.                2.                 4.                 303.
TIPTON             TN          3.                 3.                3.                 3.                 300.
CROSS              AR          3.                 3.                3.                 3.                 300.
TATE               MS          3.                 3.                3.                 3.                 300.
CARROLL            MS          5.                 2.                2.                 3.                 300.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  18 PRIORITY 8          PAGE 2
                 WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY           STATE   HUMAN RESOURCE      TRANSPORTATION       ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

MONROE            MS           4.                  2.                 3.                  3.                295.
OKTIBBEHA         MS           4.                  2.                 3.                  3.                295.
HOLMES            MS           4.                  2.                 3.                  3.                295.
MARSHALL          KY           3.                  2.                 4.                  3.                290.
CALLOWAY          KY           3.                  2.                 4.                  3.                290.
GREEN             AR           3.                  2.                 4.                  3.                290.
JACKSON           AR           3.                  2.                 4.                  3.                290.
LEE               AR           3.                  2.                 4.                  3.                290.
FULTON            KY           3.                  3.                 4.                  2.                287.
LOWNDES           MS           3.                  3.                 4.                  2.                287.
RANDOLPH          AR           4.                  1.                 4.                  3.                285.
HICKMAN           KY           4.                  2.                 4.                  2.                282.
ITAWAMBA          MS           4.                  1.                 2.                  4.                280.
DUNKLIN           AR           3.                  2.                 5.                  2.                277.
PEMISCOT          AR           3.                  2.                 5.                  2.                277.
DESOTO            MS           2.                  3.                 3.                  3.                277.
PANOLA            MS           4.                  2.                 2.                  3.                277.
GRANADA           MS           4.                  2.                 2.                  3.                277.
POINSETT          AR           3.                  2.                 3.                  3.                272.
WOODRUFF          AR           3.                  2.                 3.                  3.                272.
HARDIN            TN           4.                  1.                 3.                  3.                267.
PHILLIPS          AR           4.                  2.                 3.                  2.                264.
TALLAHATCHIE      MS           4.                  2.                 3.                  2.                264.
BALLARD           KY           3.                  2.                 4.                  2.                259.
MCCRACKEN         KY           3.                  2.                 4.                  2.                259.
CARLISLE          KY           3.                  2.                 4.                  2.                259.
DECATUR           TN           3.                  1.                 2.                  4.                257.
BENTON            TN           3.                  2.                 2.                  3.                254.
MISSISSIPPE       AR           2.                  2.                 5.                  2.                254.
ATTALA            MS           3.                  2.                 2.                  3.                254.
CRITTENDEN        AR           2.                  3.                 5.                  1.                251.
LEFLORE           MS           4.                  2.                 4.                  1.                251.
DYER              TN           3.                  2.                 3.                  2.                241.
TUNICA            MS           3.                  2.                 3.                  2.                241.
QUITMAN           MS           4.                  2.                 3.                  1.                233.
COAHOMA           MS           3.                  2.                 4.                  1.                228.
SUNFLOWER         MS           3.                  2.                 4.                  1.                228.
HUMPHREYS         MS           3.                  2.                 4.                  1.                228.
LAUDERDALE        TN           3.                  2.                 2.                  2.                223.
BOLIVAR           MS           3.                  2.                 3.                  1.                210.
WASHINGTON        MS           3.                  2.                 3.                  1.                210.
LAKE              TN           2.                  2.                 4.                  1.                205.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  19 PRIORITY 8          PAGE 1
                WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY          STATE  HUMAN RESOURCE     TRANSPORTATION        ECOLOGICAL       PHYSICAL/CHEMICAL    WEIGHTED SUM

WHITE             AR         5.                 3.                  3.                  4.               377.
DALLAS            AR         3.                 3.                  3.                  5.               362.
FAULKNER          AR         4.                 2.                  3.                  5.               357.
SHARP             AR         5.                 2.                  3.                  4.               349.
NEVADA            AR         4.                 2.                  2.                  5.               339.
FULTON            AR         4.                 1.                  3.                  5.               329.
IZARD             AR         4.                 2.                  3.                  4.               326.
INDEPENDENCE      AR         4.                 2.                  3.                  4.               326.
PRAIRIE           AR         3.                 3.                  4.                  3.               318.
PERRY             AR         3.                 2.                  2.                  5.               316.
CONWAY            AR         4.                 2.                  4.                  3.               313.
HOT SPRINGS       AR         3.                 3.                  2.                  4.               313.
COLUMBIA          AR         4.                 2.                  2.                  4.               308.
HEMPSTEAD         AR         3.                 2.                  3.                  4.               303.
VAN BUREN         AR         4.                 1.                  3.                  4.               298.
BOONE             AR         4.                 2.                  3.                  3.               295.
POPE              AR         4.                 2.                  3.                  3.               295.
SALINE            AR         1.                 4.                  2.                  4.               295.
LONOKE            AR         2.                 3.                  4.                  3.               295.
CLARK             AR         4.                 2.                  3.                  3.               295.
CLEBURNE          AR         3.                 1.                  2.                  5.               288.
GRANT             AR         3.                 1.                  2.                  5.               288.
FRANKLIN          AR         3.                 2.                  2.                  4.               285.
LOGAN             AR         3.                 2.                  2.                  4.               285.
YELL              AR         3.                 2.                  2.                  4.               285.
CLEVELAND         AR         3.                 2.                  2.                  4.               285.
STONE             AR         4.                 1.                  2.                  4.               280.
JOHNSON           AR         4.                 2.                  2.                  3.               277.
JEFFERSON         AR         2.                 3.                  3.                  3.               277.
CALHOUN           AR         4.                 2.                  2.                  3.               277.
BRADLEY           AR         4.                 2.                  2.                  3.               277.
PULASKI           AR         0.                 5.                  4.                  2.               274.
MARION            AR         3.                 2.                  3.                  3.               272.
ARKANSAS          AR         3.                 2.                  3.                  3.               272.
NEWTON            AR         4.                 1.                  3.                  3.               267.
DREW              AR         4.                 2.                  3.                  2.               264.
SCOTT             AR         3.                 1.                  2.                  4.               257.
BAXTER            AR         3.                 2.                  2.                  3.               254.
QUASHITA          AR         3.                 2.                  2.                  3.               254.
UNION             AR         3.                 2.                  2.                  3.               254.
SEARCY            AR         4.                 1.                  2.                  3.               249.
LINCOLN           AR         4.                 2.                  2.                  2.               246.
MILLER            AR         2.                 3.                  2.                  2.               228.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  19 PRIORITY 8         PAGE 2
                 WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY           STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

MONTGOMERY         AR           3.                  1.                 2.                  3.                226.
PIKE               AR           3.                  1.                 2.                  3.                226.
GARLAND            AR           3.                  2.                 2.                  2.                223.
LA FAYETTE         AR           3.                  2.                 2.                  2.                223.
DESHA              AR           3.                  2.                 3.                  1.                210.
CHICOT             AR           3.                  2.                 3.                  1.                210.
ASHLEY             AR           3.                  2.                 2.                  1.                192.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  20 PRIORITY 6          PAGE 1
                     WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY              STATE   HUMAN RESOURCE      TRANSPORTATION         ECOLOGICAL        PHYSICAL/CHEMICAL     WEIGHTED SUM

 LINCOLN              LA          4.                 3.                    3.                  5.                385.
 PIKE                 MS          5.                 2.                    4.                  4.                367.
 CLAYBOURNE           LA          4.                 2.                    3.                  5.                357.
 COPIAH               MS          4.                 2.                    3.                  5.                357.
 WALTHALL             MS          4.                 2.                    4.                  4.                344.
 BIENVILLE            LA          4.                 2.                    2.                  5.                339.
 JACKSON              LA          4.                 2.                    2.                  5.                339.
 LINCOLN              MS          5.                 2.                    2.                  4.                331.
 SIMPSON              MS          4.                 2.                    3.                  4.                326.
 J. DAVIS             MS          4.                 2.                    3.                  4.                326.
 HINDE                MS          2.                 4.                    4.                  3.                323.
 MADISON              MS          3.                 2.                    4.                  4.                321.
 WINN                 LA          4.                 2.                    1.                  5.                321.
 UNION                LA          4.                 3                     1.                  4.                318.
 FRANKLIN             MS          4.                 2.                    2.                  4.                308.
 LAWRENCE             MS          4.                 2.                    2.                  4.                308.
 AMITE                MS          4.                 2.                    2.                  4.                308.
 MARION               MS          4.                 2.                    2.                  4.                308.
 EVANGELINE           LA          3.                 2.                    3.                  4.                303.
 E. FELICIANA         LA          3.                 3.                    3.                  3.                300.
 SABINE               LA          4.                 2.                    1.                  4.                290.
 WEBSTER              LA          3.                 2.                    2.                  4.                285.
 DESOTO               LA          3.                 2.                    2.                  4.                285.
 CALDWELL             LA          3.                 2.                    2.                  4.                285.
 CADDO                LA          1.                 4.                    3.                  3.                282.
 ACADIA               LA          2.                 2.                    3.                  4.                280.
 WARREN               MS          3.                 4.                    2.                  2.                279.
 WEST CARROLL         LA          4.                 2.                    2.                  3.                277.
 YAZOO                MS          4.                 2.                    2.                  3.                277.
 NATCHITOCHES         LA          4.                 2.                    2.                  3.                277.
 JEFFERSON            MS          4.                 2.                    2.                  3.                277.
 TANGIPAHOS           LA          4.                 2.                    2.                  3.                277.
 RICHLAND             LA          3.                 2.                    3.                  3.                272.
 ADAMS                MS          3.                 3.                    3.                  2.                269.
 FRANKLIN             LA          4.                 2.                    3.                  2.                264.
 ORLEANS              LA          0.                 5.                    5.                  1.                261.
 E. BATON ROUGE       LA          0.                 5.                    3.                  2.                256.
 RED RIVER            LA          3.                 2.                    2.                  3.                254.
 GRANT                LA          3.                 2.                    2.                  3.                254.
 PTE. COUPEE          LA          3.                 3.                    2.                  2.                251.
 MADISON              LA          4.                 2.                    2.                  2.                246.
 CATAHOULA            LA          4.                 2.                    2.                  2.                246.
 WASHINGTON           LA          4.                 2.                    2.                  2.                246.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 20 PRIORITY 8

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
ST. LANDRY	LA	4.	2.	2.	2.	246.
TENSAS	LA	3.	2.	3.	2.	241.
RANKIN	MS	1.	2.	2.	4.	239.
CLAIBORNE	MS	3.	2.	1.	3.	236.
LASALLE	LA	3.	2.	1.	3.	236.
LIVINGSTON	LA	3.	3.	1.	2.	233.
LAYFAYETTE	LA	1.	2.	5.	2.	231.
GUASHITA	LA	2.	3.	2.	2.	228.
RAPIDES	LA	2.	3.	2.	2.	228.
BOSSIER	LA	1.	2.	3.	3.	226.
WILKINSON	MS	3.	1.	2.	3.	226.
ST. HELENA	LA	3.	1.	2.	3.	226.
MOREHOUSE	LA	3.	2.	2.	2.	223.
EAST CARROLL	LA	3.	2.	2.	2.	223.
SHARKEY	MS	3.	2.	2.	2.	223.
AVOYELLES	LA	3.	2.	2.	2.	223.
W. FELICIANA	LA	3.	2.	2.	2.	223.
ASCENION	LA	3.	2.	3.	1.	210.
CONCORDIA	LA	3.	2.	1.	2.	205.
ST. MARTIN PT.	LA	2.	2.	2.	2.	200.
ISAQUENA	LA	3.	1.	2.	2.	195.
ASSUMPTION	LA	3.	2.	2.	1.	192.
JEFFERSON	LA	1.	4.	1.	1.	184.
SAINT TAMMANY	LA	2.	2.	1.	2.	182.
ST. JAMES	LA	3.	2.	1.	1.	174.
IBERVILLE	LA	3.	2.	1.	1.	174.
ST. JOHN THE BAPT.	LA	3.	2.	1.	1.	174.
W. BATON ROUGE	LA	0.	3.	2.	1.	151.
ST. CHARLES	LA	2.	2.	1.	1.	151.
IBERIA	LA	2.	2.	1.	1.	151.
VERMILION	LA	1.	2.	2.	1.	146.
ST. MARY	LA	1.	2.	1.	1.	128.
TERREBONNE	LA	1.	1.	1.	1.	100.
LAFOURCHE	LA	1.	1.	1.	1.	100.
PLAQUEMINES	LA	1.	1.	0.	1.	82.
ST. MARTIN PT.	LA	1.	1.	0.	1.	82.
ST. BERNARD	LA	0.	1.	0.	1.	59.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 21 PRIORITY 30 PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
HARRIS	TX	1.	5.	3.	4.	341.
GRIMES	TX	4.	2.	2.	4.	308.
JASPER	TX	4.	2.	2.	3.	277.
WALKER	TX	2.	2.	1.	5.	275.
FORT BEND	TX	1.	3.	4.	3.	272.
NACOGOCHES	TX	3.	2.	1.	4.	267.
ANGELINA	TX	3.	2.	1.	4.	267.
TYLER	TX	4.	2.	1.	3.	259.
NEWTON	TX	4.	2.	1.	3.	259.
WALLER	TX	2.	2.	3.	3.	249.
SAN JACINTO	TX	2.	2.	1.	4.	244.
POLK	TX	3.	2.	1.	3.	236.
VERNON	LA	3.	2.	1.	3.	236.
BEAUREGARD	LA	3.	2.	1.	3.	236.
JEFFERSON	TX	1.	4.	2.	2.	233.
JEFF DAVIS	LA	2.	3.	2.	2.	228.
MONTMORENCY	TX	0.	3.	1.	4.	226.
SAN AUGUSTINE	TX	2.	1.	1.	4.	216.
HARDIN	TX	2.	2.	1.	3.	213.
ALLEN	LA	3.	2.	1.	2.	205.
GALVESTON	TX	0.	3.	3.	2.	200.
TRINITY	TX	1.	1.	1.	4.	193.
SABINE	TX	2.	1.	1.	3.	185.
LIBERTY	TX	0.	3.	2.	2.	182.
CALCASIEU	LA	0.	3.	2.	2.	182.
BRAZORIA	TX	0.	2.	2.	2.	154.
ORANGE	TX	0.	3.	1.	1.	133.
CHAMBERS	TX	0.	2.	2.	1.	123.
CAMERON	LA	1.	1.	0.	1.	82.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  22 PRIORITY 3C          PAGE 1
                  WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY              STATE  HUMAN RESOURCE     TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL     WEIGHTED SUM

MENARD                TX        5.                 1.                  3.                   5.                  352.
KIMBLE                TX        5.                 1.                  3.                   5.                  352.
SUTTON                TX        4.                 1.                  4.                   5.                  347.
EDWARDS               TX        3.                 1.                  5.                   5.                  342.
SCHLEICHER            TX        4.                 1.                  3.                   5.                  329.
KINNEY                TX        3.                 2.                  5.                   3.                  308.
KERR                  TX        3.                 1.                  3.                   5.                  306.
GILLESPIE             TX        5.                 1.                  2.                   4.                  303.
KENDALL               TX        3.                 2.                  4.                   3.                  290.
UVALDE                TX        3.                 2.                  4.                   3.                  290.
BEXAR                 TX        0.                 5.                  3.                   3.                  287.
ZAVALA                TX        4.                 1.                  4.                   3.                  285.
LASALLE               TX        4.                 2.                  4.                   2.                  282.
FAYETTE               TX        2.                 4.                  3.                   2.                  274.
WHARTON               TX        2.                 4.                  3.                   2.                  274.
COMAL                 TX        3.                 2.                  3.                   3.                  272.
MASON                 TX        4.                 1.                  3.                   3.                  267.
BURNET                TX        4.                 2.                  3.                   2.                  264.
DIMMIT                TX        3.                 1.                  4.                   3.                  262.
FRIO                  TX        3.                 2.                  4.                   2.                  259.
GOLAID                TX        3.                 2.                  4.                   2.                  259.
DUVAL                 TX        3.                 2.                  4.                   2.                  259.
BURLESON              TX        4.                 3.                  1.                   2.                  256.
MCMULLEN              TX        4.                 1.                  4.                   2.                  254.
LEE                   TX        3.                 3.                  2.                   2.                  251.
KARNES                TX        3.                 3.                  2.                   2.                  251.
DE WITT               TX        3.                 3.                  2.                   2.                  251.
JIM HOGG              TX        3.                 1.                  5.                   2.                  249.
TRAVIS                TX        0.                 4.                  4.                   2.                  246.
BASTROP               TX        2.                 3.                  3.                   2.                  246.
LAVACA                TX        4.                 2.                  2.                   2.                  246.
BEE                   TX        2.                 3.                  3.                   2.                  246.
AUSTIN                TX        3.                 2.                  3.                   2.                  241.
ATASCOSA              TX        3.                 2.                  3.                   2.                  241.
BLANCO                TX        2.                 1.                  4.                   3.                  239.
JIM WELLS             TX        2.                 2.                  4.                   2.                  236.
BROOKS                TX        2.                 2.                  4.                   2.                  236.
WASHINGTON            TX        4.                 2.                  3.                   1.                  233.
WEBB                  TX        1.                 2.                  5.                   2.                  231.
MAVERICK              TX        2.                 1.                  5.                   2.                  226.
ZAPATA                TX        2.                 1.                  5.                   2.                  226.
COLORADO              TX        3.                 2.                  2.                   2.                  223.
WILLIAMSON            TX        2.                 2.                  3.                   2.                  218.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 22 PRIORITY 3C

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
HAYS	TX	2.	2.	3.	2.	218.
MEDINA	TX	2.	2.	3.	2.	218.
LIVE OAK	TX	2.	2.	3.	2.	218.
LLANO	TX	3.	1.	3.	2.	213.
REAL	TX	0.	0.	4.	4.	196.
CALDWELL	TX	3.	2.	2.	1.	192.
GONZALES	TX	3.	2.	2.	1.	192.
VICTORIA	TX	1.	3.	3.	1.	192.
HIDALGO	TX	0.	2.	4.	2.	190.
SAN PATRICIO	TX	0.	3.	4.	1.	187.
NEUCES	TX	0.	3.	4.	1.	187.
STARR	TX	1.	1.	4.	2.	185.
MATAGORDA	TX	1.	2.	3.	1.	164.
REFUGIO	TX	1.	2.	3.	1.	164.
KLEBERG	TX	1.	2.	3.	1.	164.
KENEDY	TX	1.	2.	3.	1.	164.
WILLACY	TX	1.	2.	3.	1.	164.
GUADALUPE	TX	0.	2.	2.	2.	154.
WILSON	TX	2.	2.	1.	1.	151.
JACKSON	TX	1.	2.	2.	1.	146.
CALHOUN	TX	1.	2.	2.	1.	146.
CAMERON	TX	0.	2.	2.	1.	123.
ARANSAS	TX	1.	1.	2.	1.	118.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  23 PRIORITY 3R          PAGE 1
                       WEIGHTS   PHYSICAL =   31.   TRANS =    28.   HUMAN =    23.   ECOLOGY =    18.

COUNTY              STATE   HUMAN RESOURCE      TRANSPORTATION       ECOLOGICAL       PHYSICAL/CHEMICAL     WEIGHTED SUM

ERATH                TX          5.                  3.                  4.                  4.                  395.
STERLING             TX          5.                  1.                  5.                  5.                  388.
HARDEMAN             TX          4.                  4.                  4.                  3.                  369.
BELL                 TX          4.                  4.                  4.                  3.                  369.
MCCULLOCH            TX          4.                  2.                  3.                  5.                  357.
HAMILTON             TX          5.                  1.                  3.                  5.                  352.
COMANCHEE            TX          3.                  3.                  4.                  4.                  349.
GARZA                TX          4.                  1.                  4.                  5.                  347.
MONTAGUE             TX          5.                  3.                  3.                  3.                  346.
FOARD                TX          4.                  2.                  4.                  4.                  344.
KNOX                 TX          4.                  2.                  4.                  4.                  344.
RUNNELS              TX          4.                  2.                  4.                  4.                  344.
SAN SABA             TX          4.                  2.                  4.                  4.                  344.
BROWN                TX          4.                  3.                  4.                  3.                  341.
KING                 TX          5.                  1.                  4.                  4.                  339.
HASKELL              TX          5.                  1.                  4.                  4.                  339.
WILBARGER            TX          5.                  2.                  4.                  3.                  336.
BAYLOR               TX          3.                  2.                  3.                  5.                  334.
ROBERTSON            TX          4.                  4.                  2.                  3.                  333.
BOSQUE               TX          3.                  3.                  3.                  4.                  331.
SHACKELFORD          TX          2.                  2.                  4.                  5.                  329.
IRION                TX          2.                  1.                  5.                  5.                  319.
MILLS                TX          5.                  2.                  3.                  3.                  318.
KENT                 TX          4.                  1.                  4.                  4.                  316.
STONEWALL            TX          4.                  1.                  4.                  4.                  316.
THROCKMORTON         TX          4.                  1.                  4.                  4.                  316.
FISHER               TX          4.                  2.                  4.                  3.                  313.
NOLAN                TX          4.                  3.                  4.                  2.                  310.
FALLS                TX          4.                  3.                  4.                  2.                  310.
SCURRY               TX          5.                  1.                  4.                  3.                  308.
CORYELL              TX          5.                  1.                  4.                  3.                  308.
TARRANT              TX          0.                  5.                  4.                  3.                  305.
HOOD                 TX          3.                  2.                  3.                  4.                  303.
NAVARRO              TX          4.                  4.                  2.                  2.                  302.
COOKE                TX          3.                  3.                  3.                  3.                  300.
HILL                 TX          3.                  3.                  3.                  3.                  300.
YOUNG                TX          4.                  1.                  3.                  4.                  298.
CONCHO               TX          4.                  1.                  3.                  4.                  298.
CLAY                 TX          4.                  2.                  3.                  3.                  295.
EASTLAND             TX          4.                  3.                  3.                  2.                  292.
JACK                 TX          5.                  2.                  3.                  2.                  287.
CHEROKEE             TX          4.                  3.                  1.                  3.                  287.
JOHNSON              TX          1.                  3.                  3.                  4.                  285.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 23 PRIORITY 3P
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
TOM GREEN	TX	0.	2.	4.	5.	283.
COLEMAN	TX	4.	2.	4.	2.	282.
MCLENNAN	TX	1.	4.	3.	3.	282.
PARKER	TX	2.	2.	3.	4.	280.
SOMERVELL	TX	3.	1.	3.	4.	275.
PALO PINT	TX	3.	2.	3.	3.	272.
WISE	TX	3.	3.	3.	2.	269.
ARCHER	TX	2.	2.	4.	3.	267.
COKE	TX	4.	1.	3.	3.	267.
FANNIN	TX	4.	2.	3.	2.	264.
LAMAR	TX	4.	2.	3.	2.	264.
DELTA	TX	4.	2.	3.	2.	264.
LAMPASA	TX	4.	2.	3.	2.	264.
DALLAS	TX	0.	5.	5.	1.	261.
MITCHELL	TX	3.	2.	4.	2.	259.
CALLAHAN	TX	3.	2.	4.	2.	259.
ANDERSON	TX	4.	2.	1.	3.	259.
ELLIS	TX	1.	3.	3.	3.	254.
CAMP	TX	3.	3.	2.	2.	251.
JONES	TX	0.	3.	4.	3.	249.
STEPHENS	TX	3.	1.	3.	3.	244.
MILAM	TX	4.	3.	2.	1.	243.
HUNT	TX	3.	3.	3.	1.	238.
HENDERSON	TX	3.	3.	1.	2.	233.
GRAYSON	TX	0.	3.	3.	3.	231.
DENTON	TX	0.	3.	3.	3.	231.
CASS	TX	4.	2.	1.	2.	228.
UPSHUR	TX	4.	2.	1.	2.	228.
SMITH	TX	2.	3.	2.	2.	228.
LEON	TX	4.	2.	1.	2.	228.
HOUSTON	TX	4.	2.	1.	1.	220.
BRAZOS	TX	3.	3.	2.	2.	218.
RED RIVER	TX	4.	1.	2.	2.	218.
TAYLOR	TX	0.	3.	4.	1.	215.
HOPKINS	TX	4.	2.	2.	1.	210.
LIMESTONE	TX	3.	2.	3.	2.	205.
MORRIS	TX	3.	2.	1.	1.	197.
FRANKLIN	TX	4.	2.	1.	1.	197.
TITUS	TX	4.	2.	1.	1.	197.
FREESTONE	TX	4.	2.	1.	1.	192.
VAN ZANDT	TX	3.	2.	2.	1.	182.
ROCKWALL	TX	1.	2.	4.	1.	179.
GREGG	TX	2.	3.	1.	1.	

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  23 PRIORITY 3B        PAGE 3
                 WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY              STATE   HUMAN RESOURCE     TRANSPORTATION      ECOLOGICAL      PHYSICAL/CHEMICAL    WEIGHTED SUM

HARRISON             TX          2.                 3.                 1.                 1.                179.
WOOD                 TX          3.                 1.                 1.                 2.                177.
PANOLA               TX          3.                 2.                 1.                 1.                174.
COLLIN               TX          0.                 3.                 3.                 1.                169.
MADISON              TX          4.                 1.                 1.                 1.                169.
MARION               TX          3.                 2.                 0.                 1.                156.
RUSK                 TX          3.                 1.                 1.                 1.                146.
KAUFMAN              TX          0.                 2.                 3.                 1.                141.
RAINS                TX          2.                 1.                 1.                 1.                123.
WICHITA              TX          0.                 0.                 0.                 3.                 93.
BOWIE                TX          0.                 1.                 1.                 1.                 77.
SHELBY               TX          0.                 0.                 1.                 1.                 49.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 24 PRIORITY 3A PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
CUSTER	OK	4.	4.	4.	5.	431.
BECKHAM	OK	5.	3.	4.	5.	426.
GARFIELD	OK	5.	4.	4.	4.	423.
ELLIS	OK	4.	3.	4.	5.	403.
WOODWARD	OK	4.	3.	4.	5.	403.
ROGER MILLS	OK	4.	3.	4.	5.	403.
WASHITA	OK	4.	3.	4.	5.	403.
WOODS	OK	5.	3.	4.	4.	395.
KIOWA	OK	5.	3.	4.	4.	395.
JACKSON	OK	5.	3.	4.	4.	395.
ALFALFA	OK	3.	3.	4.	5.	380.
KAY	OK	3.	3.	4.	5.	380.
BLAINE	OK	3.	3.	4.	5.	380.
COMANCHE	OK	3.	3.	4.	5.	380.
WILSON	KS	5.	3.	3.	4.	377.
CRAWFORD	KS	5.	3.	3.	4.	377.
TILLMAN	OK	4.	2.	4.	5.	375.
SEMINOLE	OK	4.	3.	4.	4.	372.
HARMON	OK	5.	2.	4.	4.	367.
NEOSHO	KS	4.	3.	3.	4.	354.
CHEROKEE	KS	4.	3.	3.	4.	354.
CADDO	OK	3.	2.	4.	5.	352.
LAWRENCE	MO	4.	4.	3.	3.	351.
CRAIG	OK	4.	4.	3.	3.	351.
HARPER	OK	4.	1.	4.	5.	347.
CHAUTAUQUA	KS	4.	2.	4.	4.	344.
ATOKA	OK	4.	2.	2.	5.	339.
OKLAHOMA	OK	0.	5.	4.	4.	336.
PITTSBURG	OK	4.	4.	2.	3.	333.
GRADY	OK	3.	3.	3.	4.	331.
BRYAN	OK	3.	3.	3.	4.	331.
NEWTON	MO	3.	4.	3.	3.	328.
TULSA	OK	1.	5.	4.	3.	328.
OTTAWA	OK	2.	3.	4.	4.	326.
CARTER	OK	4.	2.	3.	4.	326.
LOVE	OK	4.	2.	3.	4.	326.
DEWEY	OK	3.	1.	4.	5.	324.
GARVIN	OK	4.	3.	3.	3.	323.
CHOCTAW	OK	4.	3.	3.	3.	323.
JEFFERSON	OK	3.	2.	4.	4.	321.
GRANT	OK	4.	2.	4.	3.	313.
MAJOR	OK	4.	2.	4.	3.	313.
NOBLE	OK	4.	2.	4.	3.	313.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 24 PRIORITY 3A PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
HUGHES	OK	[illegible]	3.	2.	4.	313.
GREER	OK	4.	2.	4.	3.	313.
MARSHALL	OK	2.	2.	3.	5.	311.
OSAGE	OK	1.	3.	4.	4.	303.
LOGAN	OK	3.	2.	3.	4.	303.
MONTGOMERY	KS	3.	3.	3.	3.	300.
WASHINGTON	OK	2.	3.	4.	3.	295.
MURRAY	OK	2.	3.	4.	3.	295.
COTTON	OK	3.	1.	4.	4.	293.
LABETTE	KS	4.	3.	3.	2.	292.
CREEK	OK	1.	3.	3.	4.	285.
CLEVELAND	OK	1.	3.	3.	4.	285.
JOHNSTON	OK	2.	2.	3.	4.	280.
PUSHMATAHA	OK	4.	1.	2.	4.	280.
HOWARD	AR	4.	1.	2.	4.	280.
MCDONALD	MO	4.	2.	2.	3.	277.
LINCOLN	OK	2.	3.	3.	3.	277.
POTTAWATOMIE	OK	2.	3.	3.	3.	277.
PAWNEE	OK	1.	2.	4.	4.	275.
PAYNE	OK	3.	1.	3.	4.	275.
ROGERS	OK	2.	4.	3.	2.	274.
BARTON	MO	3.	2.	3.	3.	272.
STEPHENS	OK	3.	2.	3.	3.	272.
JASPER	MO	3.	3.	3.	2.	269.
OKMULGEE	OK	3.	3.	3.	2.	269.
PONTOTOC	OK	4.	3.	0.	3.	269.
KINGFISHER	OK	2.	2.	4.	3.	267.
SEVIER	AR	3.	2.	1.	4.	267.
DADE	MO	4.	2.	3.	2.	264.
BARRY	MO	2.	2.	2.	4.	262.
BENTON	AR	3.	2.	2.	3.	254.
WASHINGTON	AR	3.	2.	2.	3.	254.
POLK	AR	3.	2.	2.	3.	254.
COAL	OK	4.	1.	2.	3.	249.
CANADIAN	OK	0.	4.	4.	2.	246.
MCCLAINE	OK	2.	3.	3.	2.	246.
LATIMER	OK	4.	2.	2.	2.	246.
OKFUSKEE	OK	3.	1.	3.	3.	244.
STONE	MO	2.	2.	2.	3.	231.
CRAWFORD	AR	2.	3.	2.	2.	228.
MCCURTAIN	OK	3.	1.	2.	3.	226.
NOWATA	OK	2.	3.	0.	3.	223.
ADAIR	OK	3.	2.	2.	2.	223.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 24 PRIORITY 3A

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
MUSKOGEE	OK	1.	3.	3.	2.	223.
LITTLE RIVER	AR	3.	2.	2.	2.	223.
MADISON	AR	4.	1.	2.	2.	218.
DELEWARE	OK	1.	1.	2.	4.	211.
LE FLORE	OK	0.	4.	2.	2.	210.
CHEROKEE	OK	2.	1.	2.	3.	203.
MAYES	OK	2.	2.	2.	2.	200.
SEQUOYAH	OK	0.	3.	3.	2.	200.
CARROLL	AR	3.	1.	2.	2.	195.
SEBASTIAN	AR	3.	1.	2.	2.	195.
MCINTOSH	OK	2.	2.	3.	1.	187.
WAGONER	OK	1.	3.	2.	1.	174.
HASKELL	OK	2.	1.	2.	2.	172.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 25 PRIORITY PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
ELLSWORTH	KS	4.	3.	4.	5.	403.
DECATUR	KS	4.	2.	4.	5.	375.
SHERIDAN	KS	4.	2.	4.	5.	375.
MITCHELL	KS	4.	2.	4.	5.	375.
CLOUD	KS	4.	2.	4.	5.	375.
RUSSELL	KS	4.	2.	4.	5.	375.
LINCOLN	KS	4.	2.	4.	5.	375.
SCOTT	KS	4.	2.	4.	5.	375.
RUSH	KS	4.	2.	4.	5.	375.
FINNEY	KS	4.	2.	4.	5.	375.
HODGEMAN	KS	4.	2.	4.	5.	375.
STANTON	KS	4.	2.	4.	5.	375.
GRANT	KS	4.	2.	4.	5.	375.
MORTON	KS	4.	2.	4.	5.	375.
BARTON	KS	4.	3.	4.	4.	372.
ANDREW	MO	4.	4.	4.	3.	369.
DICKINSON	KS	4.	4.	4.	3.	369.
NORTON	KS	4.	2.	3.	5.	357.
GRAHAM	KS	4.	2.	3.	5.	357.
ROOKS	KS	4.	2.	3.	5.	357.
VERNON	MO	4.	3.	3.	4.	354.
WASHINGTON	KS	3.	2.	4.	5.	352.
OTTOWA	KS	3.	2.	4.	5.	352.
PAWNEE	KS	3.	2.	4.	5.	352.
EDWARDS	KS	3.	2.	4.	5.	352.
OSBORNE	KS	4.	2.	4.	4.	344.
CLAY	KS	4.	2.	4.	4.	344.
TREGO	KS	4.	2.	4.	4.	344.
ELLIS	KS	4.	2.	4.	4.	344.
LANE	KS	4.	2.	4.	4.	344.
NESS	KS	4.	2.	4.	4.	344.
HASKELL	KS	4.	2.	4.	4.	344.
GRAY	KS	4.	2.	4.	4.	344.
FORD	KS	4.	2.	4.	4.	344.
STEVENS	KS	4.	2.	4.	4.	344.
SALINE	KS	4.	3.	4.	3.	341.
BARBER	KS	4.	2.	5.	3.	331.
PHILLIPS	KS	4.	2.	3.	4.	326.
SMITH	KS	4.	2.	3.	4.	326.
HENRY	MO	4.	3.	3.	3.	323.
BOURBON	KS	4.	3.	3.	3.	323.
REPUBLEC	KS	3.	2.	4.	4.	321.
RICE	KS	3.	2.	4.	4.	321.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  25 PRIORITY 3          PAGE 2
                 WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE  HUMAN RESOURCE   TRANSPORTATION   ECOLOGICAL   PHYSICAL/CHEMICAL   WEIGHTED SUM

KIOWA              KS          3.              2.              4.              4.              321.
FRANKLIN           KS          4.              4.              3.              2.              320.
GOVE               KS          4.              1.              4.              4.              316.
NEMAHA             KS          4.              2.              4.              3.              313.
BROWN              KS          4.              2.              4.              3.              313.
DE KALB            MO          4.              2.              4.              3.              313.
SEWARD             KS          4.              2.              4.              3.              313.
MEADE              KS          4.              2.              4.              3.              313.
CLARK              KS          4.              2.              4.              3.              313.
COMANCHEE          KS          4.              2.              4.              3.              313.
KINGMAN            KS          4.              3.              4.              2.              310.
WOODSON            KS          4.              3.              4.              2.              310.
GEARY              KS          3.              2.              5.              3.              308.
SHAWNEE            KS          2.              5.              3.              2.              302.
LIVINGSTON         MO          3.              3.              3.              3.              300.
JEWELL             KS          4.              2.              3.              3.              295.
DAVIESS            MO          4.              2.              3.              3.              295.
CALDWELL           MO          4.              2.              3.              3.              295.
POLK               MO          4.              2.              3.              3.              295.
SALINE             MO          4.              3.              3.              2.              292.
ALLEN              KS          4.              3.              3.              2.              292.
MARSHALL           KS          3.              2.              4.              3.              290.
PRATT              KS          3.              2.              4.              3.              290.
ATCHESON           KS          3.              3.              4.              2.              287.
ST. CLAIR          MO          3.              2.              2.              4.              285.
CLINTON            MO          4.              2.              4.              2.              282.
MORRIS             KS          4.              2.              4.              2.              282.
HARPER             KS          4.              2.              4.              2.              282.
RILEY              KS          4.              3.              4.              1.              279.
BENTON             MO          4.              2.              2.              3.              277.
CARROLL            MO          3.              2.              3.              3.              272.
FETTIS             MO          3.              2.              3.              3.              272.
COFFEY             KS          3.              2.              3.              3.              272.
BUCHANAN           MO          3.              3.              3.              2.              269.
MIAMI              KS          3.              3.              3.              2.              269.
ANDERSON           KS          4.              2.              3.              2.              264.
LINN               KS          4.              2.              3.              2.              264.
BATES              MO          4.              2.              3.              2.              264.
POTTAMATOMLE       KS          3.              2.              4.              2.              259.
MCPHERSON          KS          3.              2.              4.              2.              259.
LYON               KS          3.              2.              4.              2.              259.
GREENWOOD          KS          3.              2.              4.              2.              259.
HICKORY            MO          3.              1.              2.              4.              257.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 25 PRIORITY 8        PAGE 3
                  WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE   HUMAN RESOURCE     TRANSPORTATION       ECOLOGICAL      PHYSICAL/CHEMICAL     WEIGHTED SUM

STAFFORD            KS          0.                2.                  4.                 4.                 252.
DOUGLAS             KS          2.                2.                  3.                 3.                 249.
JACKSON             MO          1.                5.                  3.                 1.                 248.
JOHNSON             KS          2.                3.                  3.                 2.                 246.
CEDAR               MO          3.                1.                  3.                 3.                 244.
OSAGE               KS          3.                2.                  3.                 2.                 241.
JOHNSON             MO          3.                2.                  3.                 2.                 241.
RENO                KS          1.                3.                  4.                 2.                 241.
BUTLER              KS          1.                4.                  4.                 1.                 238.
JACKSON             KS          2.                2.                  4.                 2.                 236.
WABAUMKEE           KS          2.                2.                  4.                 2.                 236.
MARION              KS          2.                2.                  4.                 2.                 236.
SUMNER              KS          2.                2.                  4.                 2.                 236.
HARVEY              KS          2.                3.                  4.                 1.                 233.
COWLEY              KS          2.                3.                  4.                 1.                 233.
DONIPHAN            KS          3.                2.                  4.                 1.                 228.
RAY                 MO          2.                2.                  3.                 2.                 218.
LAFAYETTE           MO          2.                2.                  3.                 2.                 218.
CASS                MO          2.                2.                  3.                 2.                 218.
SEDGWICK            KS          0.                4.                  4.                 1.                 215.
WYANDOTTE           KS          1.                3.                  4.                 1.                 210.
CHASE               KS          2.                2.                  4.                 1.                 205.
JEFFERSON           KS          1.                3.                  3.                 1.                 192.
PLATTE              MO          2.                2.                  3.                 1.                 187.
CLAY                MO          2.                2.                  3.                 1.                 187.
LEAVENWORTH         KS          2.                2.                  3.                 1.                 187.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  26 PRIORITY 8          PAGE 1
                    WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE  HUMAN RESOURCE     TRANSPORTATION      ECOLOGICAL      PHYSICAL/CHEMICAL   WEIGHTED SUM

HYDE                SD          4.                 2.               4.                5.                375.
JACKSON             SD          4.                 2.               4.                5.                375.
JONES               SD          4.                 2.               4.                5.                375.
HAND                SD          4.                 2.               3.                5.                357.
SANDBORN            SD          4.                 2.               3.                5.                357.
MINER               SD          4.                 2.               3.                5.                357.
BRULE               SD          4.                 2.               3.                5.                357.
DOUGLAS             SD          4.                 2.               3.                5.                357.
HUTCHINSON          SD          4.                 2.               3.                5.                357.
BONHOMME            SD          3.                 2.               4.                5.                352.
LINCOLN             NB          5.                 2.               3.                4.                349.
HAAKON              SD          4.                 1.               4.                5.                347.
KIETH               NB          4.                 2.               4.                4.                344.
KEARNEY             NB          4.                 2.               4.                4.                344.
LYMAN               SD          4.                 2.               2.                5.                339.
CUSTER              NB          5.                 2.               4.                3.                336.
HOOKER              NB          4.                 2.               5.                3.                331.
THOMAS              NB          4.                 2.               5.                3.                331.
SULLY               SD          4.                 1.               3.                5.                329.
JERAULD             SD          4.                 1.               3.                5.                329.
BEADLE              SD          4.                 2.               3.                4.                326.
AURORA              SD          4.                 2.               3.                4.                326.
DAVISON             SD          4.                 2.               3.                4.                326.
HANSON              SD          4.                 2.               3.                4.                326.
POCAHONTAS          IA          4.                 2.               3.                4.                326.
CALHOUN             IA          4.                 2.               3.                4.                326.
PHELPS              NB          4.                 2.               3.                4.                326.
ADAMS               NB          4.                 2.               3.                4.                326.
CLAY                NB          4.                 2.               3.                4.                326.
STANLEY             SD          3.                 1.               4.                5.                324.
BUFFALO             SD          3.                 1.               4.                5.                324.
MELLETTE            SD          3.                 1.               4.                5.                324.
WEBSTER             IA          4.                 3.               3.                3.                323.
CARROLL             IA          4.                 3.               3.                3.                323.
DAWSON              NB          5.                 2.               3.                3.                318.
BROWN               NB          4.                 2.               4.                3.                313.
TURNER              SD          2.                 2.               3.                5.                311.
CHERRY              NB          3.                 2.               5.                3.                308.
SHERMAN             NB          4.                 2.               2.                4.                308.
BENNETT             SD          3.                 1.               3.                5.                306.
LYON                IA          3.                 2.               3.                4.                303.
TRIPP               SD          3.                 2.               3.                4.                303.
CHARLES MIX         SD          3.                 2.               3.                4.                303.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 26 PRIORITY 8
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
YANKTON	SD	3.	2.	3.	4.	303.
CEDAR	NB	3.	2.	3.	4.	303.
GUTHRIE	IA	3.	2.	3.	4.	303.
DOUGLAS	NB	2.	5.	3.	2.	302.
TODD	SD	2.	1.	4.	5.	301.
GRANT	NB	4.	2.	5.	2.	300.
JEFFERSON	NB	3.	3.	3.	3.	300.
KINGSBURY	SD	4.	2.	3.	3.	295.
BROOKINGS	SD	4.	2.	3.	3.	295.
OSCEOLA	IA	4.	2.	3.	3.	295.
DICKINSON	IA	4.	2.	3.	3.	295.
WINNEBAGO	IA	4.	2.	3.	3.	295.
SIOUX	IA	4.	2.	3.	3.	295.
OBRIEN	IA	4.	2.	3.	3.	295.
CLAY	IA	4.	2.	3.	3.	295.
PALO ALTO	IA	4.	2.	3.	3.	295.
KOSSUTH	IA	4.	2.	3.	3.	295.
HANCOCK	IA	4.	2.	3.	3.	295.
CHEROKEE	IA	4.	2.	3.	3.	295.
BUENA VISTA	IA	4.	2.	3.	3.	295.
HUMBOLDT	IA	4.	2.	3.	3.	295.
WRIGHT	IA	4.	2.	3.	3.	295.
HOLT	NB	4.	2.	3.	3.	295.
HAMILTON	IA	4.	2.	3.	3.	295.
ANTELOPE	NB	4.	2.	3.	3.	295.
STANTON	NB	4.	2.	3.	3.	295.
COLFAX	NB	4.	2.	3.	3.	295.
HOWARD	NB	4.	2.	3.	3.	295.
POLK	NB	4.	2.	3.	3.	295.
ADAIR	IA	4.	2.	3.	3.	295.
PERKINS	NB	4.	2.	3.	3.	295.
HAMILTON	NB	4.	2.	3.	3.	295.
YORK	NB	4.	2.	3.	3.	295.
GOSPER	NB	4.	2.	3.	3.	295.
FRANKLIN	NB	4.	2.	3.	3.	295.
NUCKOLLS	NB	4.	2.	3.	3.	295.
PLATTE	NB	4.	3.	3.	2.	292.
BUFFALO	NB	5.	2.	3.	2.	287.
GARFIELD	NB	4.	1.	4.	3.	285.
ROCK	NB	4.	2.	4.	2.	282.
MCCOOK	SD	2.	2.	3.	4.	280.
LINCOLN	SD	2.	2.	3.	4.	280.
GREGORY	SD	2.	2.	3.	4.	280.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 26 PRIORITY 8 PAGE 3
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
DIXON	NB	2.	2.	3.	4.	280.
IDA	IA	2.	2.	3.	4.	280.
SAUNDERS	NB	2.	2.	3.	4.	280.
VALLEY	NB	4.	2.	2.	3.	277.
GREELEY	NB	4.	2.	2.	3.	277.
SALINE	NB	2.	3.	3.	3.	277.
RED WILLOW	NB	4.	2.	2.	3.	277.
FURNAS	NB	4.	2.	2.	3.	277.
HARLAN	NB	4.	2.	2.	3.	277.
WEBSTER	NB	4.	2.	2.	3.	277.
SAC	IA	3.	2.	3.	3.	272.
GREENE	IA	3.	2.	3.	3.	272.
CUMING	NB	3.	2.	3.	3.	272.
BURT	NB	3.	2.	3.	3.	272.
ARTHUR	NB	4.	1.	5.	2.	272.
AUDUBON	IA	3.	2.	3.	3.	272.
BUTLER	NB	3.	2.	3.	3.	272.
CASS	IA	3.	2.	3.	3.	272.
MONTGOMERY	IA	3.	2.	3.	3.	272.
FILLMORE	NB	3.	2.	3.	3.	272.
THAYER	NB	3.	2.	3.	3.	272.
HUGHES	SD	2.	1.	4.	4.	270.
WASHABAUGH	SD	2.	1.	4.	4.	270.
KEYA PAHA	NB	4.	1.	3.	3.	267.
LAKE	SD	4.	2.	3.	2.	264.
MOODY	SD	4.	2.	3.	2.	264.
BOYD	NB	4.	2.	3.	2.	264.
MADISON	NB	4.	2.	3.	2.	264.
BOONE	NB	4.	2.	3.	2.	264.
ADAMS	IA	4.	2.	3.	2.	264.
UNION	IA	4.	2.	3.	2.	264.
CLARK	IA	4.	2.	3.	2.	264.
TAYLOR	IA	4.	2.	3.	2.	264.
RINGGOLD	IA	4.	2.	3.	2.	264.
DECATUR	IA	4.	2.	3.	2.	264.
ATCHISON	MO	4.	2.	3.	2.	264.
NODAWAY	MO	4.	2.	3.	2.	264.
WORTH	MO	4.	2.	3.	2.	264.
RICHARDSON	NB	4.	2.	3.	2.	264.
LOUP	NB	3.	1.	4.	3.	262.
HALL	NB	4.	3.	3.	1.	261.
LANCASTER	NB	0.	4.	3.	3.	259.
WHEELER	NB	4.	1.	4.	2.	254.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  26 PRIORITY 8          PAGE 4
                    WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL       PHYSICAL/CHEMICAL    WEIGHTED SUM

MCPHERSON           NB          4.                  1.                  4.                  2.                254.
LOGAN               NB          4.                  1.                  4.                  2.                254.
MADISON             IA          3.                  2.                  2.                  3.                254.
POLK                IA          1.                  4.                  3.                  2.                251.
BOONE               IA          2.                  2.                  3.                  3.                249.
STORY               IA          2.                  2.                  3.                  3.                249.
SEWARD              NB          2.                  2.                  3.                  3.                249.
DODGE               NB          2.                  3.                  3.                  2.                246.
POTTAWATTAMIE       IA          2.                  3.                  3.                  2.                246.
OTODE               NB          2.                  3.                  3.                  2.                246.
HARRISON            MO          4.                  2.                  2.                  2.                246.
GENTRY              MO          4.                  2.                  2.                  2.                246.
UNION               SD          3.                  2.                  3.                  2.                241.
KNOX                NB          3.                  2.                  3.                  2.                241.
PIERCE              NB          3.                  2.                  3.                  2.                241.
WAYNE               NB          3.                  2.                  3.                  2.                241.
THURSTON            NB          3.                  2.                  3.                  2.                241.
CRAWFORD            IA          3.                  2.                  3.                  2.                241.
HARRISON            IA          3.                  2.                  3.                  2.                241.
SHELBY              IA          3.                  2.                  3.                  2.                241.
NANCE               NB          3.                  2.                  3.                  2.                241.
FREMONT             IA          3.                  2.                  3.                  2.                241.
PAGE                IA          3.                  2.                  3.                  2.                241.
NAMAHA              NB          3.                  2.                  3.                  2.                241.
FRONTIER            NB          5.                  2.                  2.                  1.                238.
BLAINE              NB          2.                  2.                  4.                  2.                236.
EMMET               IA          4.                  2.                  3.                  1.                233.
WARREN              IA          2.                  2.                  2.                  3.                231.
WOODBURY            IA          1.                  3.                  3.                  2.                223.
CLAY                SD          2.                  2.                  3.                  2.                218.
PLYMOUTH            IA          2.                  2.                  3.                  2.                218.
DALLAS              IA          2.                  2.                  3.                  2.                218.
MILLS               IA          2.                  2.                  3.                  2.                218.
JOHNSON             NB          2.                  2.                  3.                  2.                218.
GAGE                NB          2.                  2.                  3.                  2.                218.
HOLT                MO          2.                  2.                  3.                  2.                218.
SARPY               NB          2.                  3.                  3.                  1.                215.
CASI                NB          2.                  3.                  3.                  1.                215.
MERRICK             NB          3.                  2.                  3.                  1.                210.
PAWNEE              NB          3.                  2.                  3.                  1.                210.
MONONA              IA          2.                  2.                  2.                  2.                200.
MONNEHAHA           SD          1.                  2.                  3.                  2.                195.
DAKOTA              MO          1.                  2.                  3.                  2.                195.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  26 PRIORITY 8          PAGE 5
                WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE  HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL       PHYSICAL/CHEMICAL    WEIGHTED SUM

WASHINGTON          NB          1.                 2.                  3.                 2.               195.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 27 PRIORITY 8

WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
MORRILL	NB	4.	3.	4.	5.	403.
LARAMIE	WY	4.	3.	4.	5.	403.
LINCOLN	CO	3.	3.	4.	5.	380.
NIOBRARA	WY	4.	2.	4.	5.	375.
PLATTE	WY	4.	2.	4.	5.	375.
GOSHEN	WY	4.	2.	4.	5.	375.
PHILLIPS	CO	4.	2.	4.	5.	375.
YUMA	CO	4.	2.	4.	5.	375.
CHEYENNE	CO	4.	2.	4.	5.	375.
PROWERS	CO	4.	2.	4.	5.	375.
HAMILTON	KS	4.	2.	4.	5.	375.
CHEYENNE	NB	4.	3.	4.	4.	372.
SHERMAN	KS	5.	2.	4.	4.	367.
GREELEY	KS	5.	2.	4.	4.	367.
CONVERSE	WY	4.	2.	5.	4.	362.
BOX BUTTE	NB	4.	2.	3.	5.	357.
WELD	CO	2.	3.	4.	5.	357.
DUNDY	NB	4.	2.	3.	5.	357.
ELBERT	CO	2.	3.	4.	5.	357.
FALL RIVER	SD	3.	2.	4.	5.	352.
SIOUX	NB	3.	2.	4.	5.	352.
CHEYENNE	KS	3.	2.	4.	5.	352.
BENT	CO	3.	2.	4.	5.	352.
BACA	CO	3.	2.	4.	5.	352.
LOGAN	CO	3.	3.	4.	4.	349.
LAS ANIMAS	CO	3.	3.	4.	4.	349.
MEADE	SD	4.	1.	4.	5.	347.
BANNER	NB	4.	1.	4.	5.	347.
SEDGWICK	CO	4.	2.	4.	4.	344.
THOMAS	KS	4.	2.	4.	4.	344.
WICHITA	KS	4.	2.	4.	4.	344.
KEARNEY	KS	4.	2.	4.	4.	344.
BUTTE	SD	5.	1.	4.	4.	339.
CAMPBELL	WY	5.	1.	4.	4.	339.
MORGAN	CO	2.	3.	3.	5.	339.
SCOTTS BLUFF	NB	3.	2.	3.	5.	334.
DEUEL	NB	3.	3.	3.	4.	331.
HITCHCOCK	NB	4.	2.	3.	4.	326.
RAWLINS	KS	4.	2.	3.	4.	326.
KIT CARSON	CO	4.	2.	3.	4.	326.
WALLACE	KS	4.	2.	3.	4.	326.
LOGAN	KS	4.	2.	3.	4.	326.
OTERO	CO	2.	3.	4.	4.	326.

SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 27 PRIORITY 8 PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
CUSTER	SD	3.	2.	4.	4.	321.
GARDEN	NB	3.	2.	4.	4.	321.
WESTON	WY	4.	1.	4.	4.	316.
NATRONA	WY	4.	1.	4.	4.	316.
KIMBALL	NB	4.	2.	4.	3.	313.
CROOK	WY	3.	1.	3.	5.	306.
PENNINGTON	SD	3.	1.	3.	5.	306.
DAWES	NB	1.	2.	4.	5.	306.
WASHINGTON	CO	3.	2.	3.	4.	303.
KIOWA	CO	3.	2.	3.	4.	303.
SHANNON	SD	2.	1.	4.	5.	301.
SHERIDAN	NB	2.	2.	4.	4.	298.
CHASE	NB	4.	1.	3.	4.	298.
HAYES	NB	4.	1.	3.	4.	298.
ALBANY	WY	3.	2.	4.	3.	290.
JOHNSON	WY	4.	1.	4.	3.	285.
DOUGLAS	CO	1.	3.	3.	4.	285.
ADAMS	CO	0.	3.	4.	4.	280.
SHERIDAN	WY	3.	2.	3.	3.	272.
FREMONT	CO	2.	2.	4.	3.	267.
CROWLEY	CO	2.	2.	4.	3.	267.
HUERFANO	CO	2.	2.	4.	3.	267.
FREEMONT	WY	3.	1.	4.	3.	262.
CUSTER	CO	3.	1.	4.	3.	262.
DENVER	CO	0.	5.	5.	1.	261.
ARAPAHOE	CO	0.	2.	4.	4.	252.
LARIMER	CO	3.	3.	2.	2.	251.
EL PASO	CO	0.	3.	4.	3.	249.
PUEBLO	CO	0.	4.	4.	2.	246.
BOULDER	CO	1.	2.	2.	2.	177.
LAWRENCE	SD	2.	1.	1.	2.	154.
TELLER	CO	2.	1.	1.	2.	154.
JEFFERSON	CO	0.	2.	3.	1.	141.
CLEAR CREEK	CO	1.	1.	2.	1.	118.
GILPIN	CO	0.	0.	2.	1.	67.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  28 PRIORITY 8          PAGE 1
                    WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY            STATE   HUMAN RESOURCE      TRANSPORTATION       ECOLOGICAL       PHYSICAL/CHEMICAL    WEIGHTED SUM

QUAY                NM          5.                 2.                  4.                 5.               398.
DALLAM              TX          5.                 3.                  2.                 5.               390.
COLLINGSWORTH       TX          5.                 2.                  3.                 5.               380.
UNION               NM          5.                 2.                  4.                 4.               367.
SHERMAN             TX          5.                 2.                  2.                 5.               362.
CIMARRON            OK          4.                 2.                  3.                 5.               357.
HARTLEY             TX          4.                 2.                  3.                 5.               357.
HEMPHILL            TX          4.                 2.                  3.                 5.               357.
DONLEY              TX          4.                 2.                  3.                 5.               357.
CHILDRESS           TX          4.                 2.                  3.                 5.               357.
MOTLEY              TX          4.                 2.                  3.                 5.               357.
COTTLE              TX          4.                 2.                  3.                 5.               357.
WHEELER             TX          4.                 3.                  3.                 4.               354.
HANSFORD            TX          4.                 2.                  2.                 5.               339.
HALL                TX          3.                 2.                  3.                 5.               334.
OCHILTREE           TX          5.                 2.                  2.                 4.               331.
LIPSCOMB            TX          5.                 2.                  2.                 4.               331.
ROBERTS             TX          3.                 2.                  4.                 4.               321.
FLOYD               TX          3.                 2.                  2.                 5.               316.
BRISCOE             TX          3.                 1.                  3.                 5.               306.
CURRY               NM          4.                 3.                  2.                 3.               305.
PARMER              TX          4.                 3.                  2.                 3.               305.
BEAVER              OK          5.                 2.                  3.                 2.               287.
DEAF SMITH          TX          3.                 2.                  2.                 4.               285.
SWISHER             TX          3.                 2.                  2.                 4.               285.
LAMB                TX          3.                 2.                  2.                 4.               285.
HALE                TX          3.                 2.                  2.                 4.               285.
ARMSTRONG           TX          2.                 2.                  3.                 4.               280.
OLDHAM              TX          3.                 2.                  3.                 3.               272.
CARSON              TX          3.                 2.                  3.                 3.               272.
TEXAS               OK          5.                 2.                  2.                 2.               269.
COCHRAN             TX          4.                 1.                  3.                 3.               267.
CROSBY              TX          2.                 1.                  2.                 5.               265.
GRAY                TX          4.                 2.                  3.                 2.               264.
CASTRO              TX          3.                 1.                  2.                 4.               257.
ROOSEVELT           NB          4.                 2.                  2.                 2.               246.
BAILEY              TX          4.                 2.                  2.                 2.               246.
DICKENS             TX          3.                 1.                  3.                 3.               244.
POTTER              TX          0.                 5.                  3.                 1.               225.
MOORE               TX          2.                 2.                  2.                 2.               200.
HOCKLEY             TX          2.                 2.                  2.                 2.               200.
HUTCHINSON          TX          2.                 2.                  3.                 1.               187.
RANDALL             TX          0.                 2.                  2.                 3.               185.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  28 PRIORITY 8          PAGE 2
                 WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY           STATE  HUMAN RESOURCE     TRANSPORTATION        ECOLOGICAL       PHYSICAL/CHEMICAL    WEIGHTED SUM

LUBBOCK             TX          0.                3.                  2.                  2.                182.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  29 PRIORITY 8          PAGE 1
                WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY          STATE  HUMAN RESOURCE     TRANSPORTATION        ECOLOGICAL       PHYSICAL/CHEMICAL   WEIGHTED SUM

PECOS              TX        4.                2.                   5.                 5.                393.
LUNA               NM        2.                4.                   5.                 4.                372.
CROCKETT           TX        4.                1.                   5.                 5.                365.
UPTON              TX        4.                1.                   5.                 5.                365.
DONA ANA           NM        3.                4.                   5.                 3.                364.
REEVES             TX        4.                3.                   5.                 3.                359.
TERRELL            TX        2.                2.                   5.                 3.                347.
CULBERTSON         TX        3.                2.                   5.                 5.                339.
EDDY               NM        4.                1.                   5.                 4.                334.
LOVING             TX        4.                1.                   5.                 4.                334.
REAGAN             TX        4.                1.                   5.                 4.                334.
WARD               TX        4.                2.                   5.                 3.                331.
MARTIN             TX        4.                1.                   4.                 4.                316.
VAL VERDE          TX        2.                2.                   5.                 4.                316.
GLASSCOCK          TX        4.                1.                   4.                 4.                316.
LEA                NM        5.                1.                   4.                 3.                308.
YOAKUM             TX        5.                1.                   4.                 3.                308.
JEFF DAVIS         TX        3.                2.                   5.                 3.                308.
CHAVES             NM        4.                1.                   5.                 3.                303.
WINKLER            TX        4.                1.                   5.                 3.                303.
CRANE              TX        4.                1.                   5.                 3.                303.
GAINES             TX        4.                1.                   4.                 3.                285.
DAWSON             TX        4.                1.                   4.                 3.                285.
BORDEN             TX        4.                1.                   4.                 3.                285.
ANDREWS            TX        4.                1.                   4.                 3.                285.
HUDSPETH           TX        2.                2.                   5.                 3.                285.
EL PASO            TX        1.                5.                   5.                 1.                284.
SIERRA             NM        4.                2.                   4.                 2.                282.
OTERO              NM        4.                2.                   4.                 2.                282.
TERRY              TX        4.                1.                   3.                 3.                267.
LYNN               TX        3.                1.                   4.                 3.                262.
HOWARD             TX        3.                2.                   4.                 2.                259.
PRESIDIO           TX        2.                2.                   5.                 2.                254.
BREWSTER           TX        2.                2.                   5.                 2.                254.
MIDLAND            TX        1.                2.                   4.                 3.                244.
GRANT              NM        3.                1.                   4.                 2.                231.
ECTOR              TX        1.                2.                   5.                 1.                200.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  30 PRIORITY 8          PAGE 1
                    WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY              STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL     WEIGHTED SUM

GUADALUPE            NM           5.                  4.                  4.                  4.                  423.
HARDING              NM           5.                  1.                  4.                  5.                  370.
DE BACA              NM           5.                  2.                  4.                  4.                  367.
MCKINLEY             NM           3.                  2.                  4.                  5.                  352.
VALENCIA             NM           2.                  5.                  4.                  3.                  351.
MOFFAT               CO           4.                  1.                  4.                  5.                  347.
SAN MIGUEL           NM           3.                  2.                  4.                  4.                  321.
LINCOLN              NM           3.                  2.                  4.                  4.                  321.
TORRANCE             NM           3.                  3.                  4.                  3.                  318.
MESA                 CO           4.                  2.                  4.                  3.                  313.
COLFAX               NM           4.                  2.                  4.                  3.                  313.
SAN JUAN             NM           2.                  1.                  4.                  5.                  301.
SAN MIGUEL           CO           4.                  1.                  3.                  4.                  298.
SANDOVAL             NM           2.                  2.                  4.                  4.                  298.
SANTA FE             NM           2.                  2.                  4.                  4.                  298.
RIO BLANCO           CO           3.                  1.                  4.                  4.                  293.
MORA                 NM           3.                  2.                  4.                  3.                  290.
SOCORRO              NM           3.                  2.                  4.                  3.                  290.
ALAMOSA              CO           4.                  1.                  4.                  3.                  285.
BERNALILLO           NM           0.                  3.                  4.                  4.                  280.
COSTILLA             CO           3.                  1.                  3.                  4.                  275.
LOS ALAMOS           NM           4.                  2.                  3.                  2.                  264.
MONTROSE             CO           3.                  1.                  4.                  3.                  262.
RIO ARRIBA           NM           1.                  1.                  3.                  5.                  260.
DOLORES              CO           3.                  1.                  2.                  4.                  257.
ROUTT                CO           3.                  2.                  2.                  3.                  254.
MONTEZUMA            CO           2.                  1.                  3.                  4.                  252.
GARFIELD             CO           3.                  1.                  3.                  3.                  244.
DELTA                CO           3.                  1.                  3.                  3.                  244.
SAGUACHE             CO           3.                  1.                  3.                  3.                  244.
TAOS                 NM           3.                  1.                  3.                  3.                  244.
CATRON               NM           3.                  1.                  3.                  3.                  244.
EAGLE                CO           3.                  2.                  3.                  2.                  241.
ARCHULETA            CO           2.                  1.                  2.                  4.                  234.
JACKSON              CO           2.                  1.                  3.                  3.                  221.
RIO GRANDE           CO           2.                  1.                  3.                  3.                  221.
LA PLATA             CO           2.                  1.                  3.                  3.                  221.
OURAY                CO           3.                  1.                  3.                  2.                  213.
CONEJOS              CO           3.                  1.                  3.                  2.                  213.
GRAND                CO           2.                  2.                  2.                  2.                  200.
GUNNISON             CO           2.                  1.                  3.                  2.                  190.
PITKIN               CO           2.                  1.                  2.                  2.                  172.
LAKE                 CO           2.                  2.                  2.                  1.                  169.
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SGRTED WEIGH,ED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  30 PRIORITY 8          PAGE 2
                WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY           STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

SAN JU,N            CO         3.                  1.                  2.                  1.                 164.
SUMMIT              CO         2.                  1.                  1.                  2.                 154.
CHAFFEE             CO         2.                  1.                  2.                  1.                 141.
HINSDALE            CO         2.                  1.                  2.                  1.                 141.
MINERAL             CO         2.                  1.                  2.                  1.                 141.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  31 PRIORITY 8          PAGE 1
                    WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY             STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL     WEIGHTED SUM

YUMA                AZ          4.                  3.                   5.                   3.                 359.
MARICOPA            AZ          1.                  5.                   5.                   3.                 346.
YAVAPAI             AZ          4.                  3.                   4.                   3.                 341.
PINAL               AZ          3.                  3.                   5.                   3.                 336.
COCONINO            AZ          2.                  3.                   4.                   4.                 326.
NAVAJO              AZ          2.                  1.                   4.                   5.                 301.
APACHE              AZ          2.                  1.                   4.                   5.                 301.
MOHAVE              AZ          4.                  2.                   4.                   2.                 282.
GRAHAM              AZ          4.                  1.                   4.                   2.                 254.
COCHISE             AZ          2.                  2.                   4.                   2.                 236.
HIDALG              NM          2.                  2.                   4.                   2.                 236.
PIMA                AZ          1.                  2.                   5.                   2.                 231.
GILA                AZ          3.                  1.                   4.                   1.                 200.
GREENLEE            AZ          2.                  1.                   3.                   1.                 159.
SANTA CRUZ          AZ          1.                  1.                   4.                   1.                 154.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  32 PRIORITY 4B          PAGE 1
                    WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY               STATE   HUMAN RESOURCE        TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

LINCOLN               NV          4.                   2.                  5.                  5.                  393.
NYE                   NV          5.                   1.                  5.                  5.                  388.
KERN                  CA          4.                   3.                  4.                  4.                  372.
ESMERALDA             NV          4.                   1.                  5.                  5.                  365.
CLARK                 NV          2.                   2.                  5.                  5.                  347.
RIVERSIDE             CA          4.                   2.                  4.                  4.                  344.
SAN BERNARDINO        CA          2.                   4.                  5.                  3.                  341.
INYO                  CA          4.                   1.                  5.                  3.                  303.
IMPERIAL              CA          1.                   2.                  5.                  4.                  293.
TULARE                CA          4.                   3.                  3.                  2.                  292.
LOS ANGELES           CA          0.                   5.                  4.                  1.                  243.
ORANGE                CA          0.                   3.                  4.                  2.                  218.
SAN DIEGO             CA          1.                   2.                  4.                  2.                  213.
VENTURA               CA          1.                   3.                  3.                  1.                  192.
KINGS                 CA          2.                   2.                  3.                  1.                  187.
SAN LOUIS OBISPO      CA          2.                   2.                  2.                  1.                  169.
SANTA BARBARA         CA          0.                   2.                  3.                  1.                  141.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  33 PRIORITY 8           PAGE 1
                WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY          STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL     WEIGHTED SUM

SWEETWATER        WY          4.                  2.                  5.                  5.                  393.
JEFFERSON         ID          4.                  2.                  4.                  5.                  375.
CARBON            WY          4.                  2.                  4.                  5.                  375.
TOOELE            UT          3.                  2.                  5.                  5.                  370.
BUTTE             ID          5.                  2.                  4.                  4.                  367.
WHITE PINE        NV          4.                  1.                  5.                  5.                  365.
LINCOLN           ID          4.                  2.                  5.                  4.                  362.
MINIDOKA          ID          4.                  2.                  5.                  4.                  362.
LANDER            NV          4.                  2.                  5.                  4.                  362.
EUREKA            NV          4.                  2.                  5.                  4.                  362.
JUAB              UT          4.                  2.                  5.                  4.                  362.
BINGHAM           ID          3.                  2.                  4.                  5.                  352.
TWIN FALLS        ID          3.                  2.                  4.                  5.                  352.
ELKO              NV          4.                  2.                  4.                  4.                  344.
BOX ELDER         UT          4.                  2.                  4.                  4.                  344.
MILLARD           UT          4.                  2.                  4.                  4.                  344.
EMERY             UT          4.                  2.                  4.                  4.                  344.
SAN JUAN          UT          3.                  1.                  5.                  5.                  342.
OWYHEE            ID          4.                  1.                  5.                  4.                  334.
POWER             ID          2.                  2.                  4.                  5.                  329.
WAYNE             UT          3.                  1.                  4.                  5.                  324.
JEROME            ID          3.                  2.                  4.                  4.                  321.
UINTA             WY          3.                  2.                  4.                  4.                  321.
GRAND             UT          3.                  2.                  4.                  4.                  321.
BEAVER            UT          3.                  2.                  4.                  4.                  321.
IRON              UT          3.                  2.                  4.                  4.                  321.
MADISON           ID          3.                  2.                  3.                  4.                  303.
CARIBOU           ID          3.                  2.                  3.                  4.                  303.
CARBON            UT          3.                  2.                  3.                  4.                  303.
SANPETE           UT          3.                  2.                  3.                  4.                  303.
WASHINGTON        UT          2.                  1.                  4.                  5.                  301.
GOODING           ID          2.                  2.                  4.                  4.                  298.
BONNEVILLE        ID          4.                  2.                  3.                  3.                  295.
CASSIA            ID          3.                  1.                  4.                  4.                  293.
CLARK             ID          3.                  2.                  4.                  3.                  290.
BANNOCK           ID          2.                  3.                  3.                  3.                  277.
ADA               ID          1.                  2.                  4.                  4.                  275.
GARFIELD          UT          3.                  1.                  3.                  4.                  275.
FREEMONT          ID          3.                  2.                  3.                  3.                  272.
LINCOLN           WY          3.                  2.                  3.                  3.                  272.
BEAR LAKE         ID          2.                  2.                  4.                  3.                  267.
BLAINE            ID          3.                  1.                  4.                  3.                  262.
KANE              UT          3.                  1.                  4.                  3.                  262.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITFS FOR REGION  33 PRIORITY 8          PAGE 2
              WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY          STATE   HUMAN RESOURCE     TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

 DAVIS            UT          2.                 4.                  4.                  1.                 261.
 CONYON           ID          1.                 2.                  3.                  4.                 257.
 SUBLETTE         WY          2.                 1.                  3.                  4.                 252.
 UINTAH           UT          2.                 1.                  3.                  4.                 252.
 ELMORE           ID          2.                 2.                  3.                  3.                 249.
 FRANKLIN         ID          2.                 2.                  3.                  3.                 249.
 ONEIDA           ID          3.                 1.                  3.                  3.                 244.
 SEVIER           UT          3.                 1.                  3.                  3.                 244.
 DAGGETT          UT          2.                 1.                  4.                  3.                 239.
 PIUTE            UT          2.                 1.                  4.                  3.                 239.
 DUCHESNE         UT          0.                 1.                  3.                  5.                 237.
 CAMAS            ID          3.                 1.                  2.                  3.                 226.
 CACHE            UT          1.                 2.                  3.                  3.                 226.
 RICH             UT          3.                 1.                  4.                  1.                 200.
 SUMMIT           UT          2.                 1.                  3.                  2.                 190.
 CUSTER           ID          3.                 1.                  3.                  1.                 182.
 WEBER            UT          1.                 3.                  2.                  1.                 174.
 TETON            ID          2.                 1.                  2.                  2.                 172.
 MORGAN           UT          1.                 2.                  3.                  1.                 164.
 LEMHI            ID          2.                 1.                  2.                  1.                 141.
 WASATCH          UT          2.                 1.                  2.                  1.                 141.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 34 PRIORITY 8 PAGE 1
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
CUSTER	MT	4.	2.	4.	5.	375.
PRAIRIE	MT	4.	2.	3.	5.	357.
WHEATLAND	MT	3.	2.	4.	5.	352.
GOLDEN VALLEY	MT	3.	2.	4.	5.	352.
MUSSELSHELL	MT	3.	2.	4.	5.	352.
FALLON	MT	3.	2.	4.	5.	352.
FERGUS	MT	4.	1.	4.	5.	347.
PETROLEUM	MT	4.	1.	4.	5.	347.
GARFIELD	MT	4.	1.	4.	5.	347.
CARTER	MT	4.	1.	4.	5.	347.
DAWSON	MT	4.	2.	4.	4.	344.
ROSEBUD	MT	4.	2.	4.	4.	344.
SWEET GRASS	MT	3.	2.	4.	4.	321.
TREASURE	MT	3.	2.	4.	4.	321.
WIBAUX	MT	4.	1.	4.	4.	316.
JUDITH BASIN	MT	2.	2.	3.	5.	311.
RICHLAND	MT	3.	1.	3.	5.	306.
CASCADE	MT	1.	3.	4.	4.	303.
STILLWATER	MT	3.	2.	3.	4.	303.
VALLEY	MT	2.	1.	4.	5.	301.
SHENDA	MT	2.	1.	4.	5.	301.
CHOUTEAU	MT	4.	1.	3.	4.	298.
POWELL	MT	3.	4.	3.	2.	297.
PHILLIPS	MT	3.	1.	4.	4.	293.
POWDER RIVER	MT	3.	1.	4.	4.	293.
ROOSEVELT	MT	2.	1.	3.	5.	283.
TOOLE	MT	2.	2.	3.	4.	280.
HILL	MT	2.	2.	3.	4.	280.
WASHAKIE	WY	3.	1.	5.	3.	280.
PONDERA	MT	3.	1.	3.	4.	275.
MCCONE	MT	3.	1.	3.	4.	275.
YELLOWSTONE	MT	1.	2.	4.	4.	275.
LEWIS AND CLARK	MT	2.	4.	3.	2.	274.
JEFFERSON	MT	2.	4.	3.	2.	274.
SILVER BOW	MT	2.	5.	3.	1.	271.
LIBERTY	MT	2.	1.	4.	4.	270.
BLAINE	MT	2.	1.	4.	4.	270.
DANIELS	MT	2.	1.	4.	4.	270.
BROAD WATER	MT	3.	3.	3.	2.	269.
BIG HORN	MT	2.	2.	4.	3.	267.
BIG HORN	WY	3.	1.	4.	3.	262.
MEAGHER	MT	2.	2.	3.	3.	249.
CARBON	MT	2.	2.	3.	3.	249.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  34 PRIORITY 8          PAGE 2
                  WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY          STATE  HUMAN RESOURCE     TRANSPORTATION       ECOLOGICAL      PHYSICAL/CHEMICAL   WEIGHTED SUM

GALLATIN          MT         2.                3.                  3.                 2.               246.
TETON             MT         3.                1.                  3.                 3.               244.
HOT SPRINGS       WY         2.                1.                  4.                 3.               239.
MISSOULA          MT         3.                2.                  2.                 2.               223.
PARK              MT         2.                2.                  3.                 2.               218.
SANDERS           MT         2.                2.                  2.                 2.               200.
GRANITE           MT         2.                2.                  2.                 2.               200.
GLACIER           MT         1.                1.                  3.                 3.               198.
DEER LODGE        MT         2.                3.                  2.                 1.               197.
LAKE              MT         2.                1.                  3.                 2.               190.
MADISON           MT         2.                1.                  3.                 2.               190.
BEAVERHEAD        MT         2.                2.                  3.                 1.               187.
LINCOLN           MT         2.                1.                  2.                 2.               172.
PARK              WY         1.                1.                  3.                 2.               167.
MINERAL           MT         2.                2.                  1.                 1.               151.
RAVALLI           MT         2.                1.                  2.                 1.               141.
FLATHEAD          MT         1.                1.                  2.                 1.               118.
TETON             WY         0.                1.                  2.                 1.                95.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 35 PRIORITY 4A   PAGE 1
WEIGHTS   PHYSICAL = 31.   TRANS = 28.   HUMAN = 23.   ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
WASHOE	NV	2.	4.	5.	5.	403.
PERSHING	NV	5.	2.	5.	4.	385.
CHURCHILL	NV	5.	3.	4.	3.	364.
HUMBOLDT	NV	2.	2.	5.	5.	347.
MODOC	CA	3.	3.	3.	4.	331.
FRESNO	CA	2.	3.	3.	4.	308.
LASSEN	CA	3.	2.	3.	4.	303.
MINERAL	NV	4.	1.	5.	3.	303.
SISKIYOU	CA	3.	3.	2.	3.	282.
SACRAMENTO	CA	1.	4.	3.	3.	282.
LYON	NV	2.	1.	4.	4.	270.
STANISLAUS	CA	3.	3.	3.	2.	269.
STOREY	NV	2.	1.	5.	3.	257.
CONTRA COSTA	CA	0.	5.	3.	2.	256.
SAN JOAQUIN	CA	1.	4.	3.	2.	251.
TEHAMA	CA	2.	2.	3.	3.	249.
GLENN	CA	2.	2.	3.	3.	249.
COLUSA	CA	2.	2.	3.	3.	249.
MARIPOSA	CA	4.	1.	2.	3.	249.
MONTEREY	CA	2.	2.	3.	3.	249.
BUTTE	CA	4.	2.	2.	2.	246.
ALEMEDA	CA	0.	4.	4.	2.	246.
MERCED	CA	2.	3.	3.	2.	246.
MADERA	CA	3.	1.	3.	3.	244.
YUBA	CA	3.	2.	3.	2.	241.
ORMSBY	NV	2.	1.	4.	3.	239.
MONO	CA	2.	1.	4.	3.	239.
CALAVERAS	CA	4.	1.	3.	2.	236.
SHASTA	CA	2.	2.	2.	3.	231.
YOLO	CA	1.	3.	3.	2.	223.
SUTTER	CA	2.	2.	3.	2.	218.
SANTA CLARA	CA	0.	3.	4.	2.	218.
DOUGLAS	NV	1.	1.	4.	3.	216.
NAPA	CA	1.	2.	4.	2.	213.
SAN BENITO	CA	3.	1.	3.	2.	213.
MENDOCINO	CA	1.	2.	2.	3.	208.
LAKE	CA	2.	1.	4.	2.	208.
PLUMAS	CA	2.	4.	1.	1.	207.
TUOLUMNE	CA	3.	1.	2.	2.	195.
SONOMA	CA	1.	2.	3.	2.	195.
SIERRA	CA	4.	1.	2.	1.	187.
AMADOR	CA	3.	1.	3.	1.	182.
HUMBOLDT	CA	1.	1.	2.	3.	180.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  35 PRIORITY 4A          PAGE 2
                   WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY              STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

PLACER               CA           1.                 2.                    2.                   2.                177.
SOLANO               CA           0.                 2.                    3.                   2.                172.
SAN MATEO            CA           0.                 3.                    3.                   1.                169.
DEL NORTE            CA           1.                 1.                    1.                   3.                162.
TRINITY              CA           2.                 1.                    1.                   2.                154.
SANTA CRUZ           CA           0.                 3.                    2.                   1.                151.
NEVADA               CA           2.                 1.                    2.                   1.                141.
ALPINE               CA           2.                 1.                    2.                   1.                141.
MARIN                CA           0.                 2.                    3.                   1.                141.
EL DORADO            CA           1.                 1.                    2.                   1.                118.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  36 PRIORITY 8          PAGE 1
                   WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY          STATE  HUMAN RESOURCE    TRANSPORTATION     ECOLOGICAL     PHYSICAL/CHEMICAL   WEIGHTED SUM

FRANKLIN          WA         5.                3.                4.                5.               426.
BENTON            WA         4.                3.                4.                5.               403.
WHITMAN           WA         5.                2.                4.                5.               398.
MALHEUR           OR         5.                1.                5.                5.               388.
LINCOLN           WA         4.                2.                4.                5.               375.
ADAMS             WA         2.                3.                4.                5.               357.
WALLA WALLA       WA         4.                2.                3.                5.               357.
GRANT             WA         3.                2.                4.                5.               352.
SHERMAN           OR         4.                2.                4.                4.               344.
GILLIAM           OR         4.                2.                4.                4.               344.
HARNEY            OR         5.                1.                4.                4.               339.
DESCHUTES         OR         3.                2.                3.                5.               334.
DOUGLAS           WA         3.                1.                4.                5.               324.
MORROW            OR         4.                1.                4.                4.               316.
COLUMBIA          WA         3.                2.                3.                4.               303.
UMATILLA          OR         3.                2.                3.                4.               303.
KITTITAS          WA         3.                3.                3.                3.               300.
KLICKITAT         WA         4.                1.                3.                4.               298.
PAYETTE           ID         3.                1.                4.                4.               293.
SPOKANE           WA         1.                3.                3.                4.               285.
LATAH             ID         3.                2.                2.                4.               285.
GARFIELD          WA         3.                1.                3.                4.               275.
ASOTIN            WA         3.                1.                3.                4.               275.
LAKE              OR         3.                1.                3.                4.               275.
WASCO             OR         3.                2.                3.                3.               272.
BAKER             OR         3.                2.                3.                3.               272.
WALLOWA           OR         4.                1.                3.                3.               267.
LEWIS             WA         3.                3.                1.                3.               264.
STEVENS           WA         2.                2.                2.                4.               262.
WASHINGTON        ID         3.                1.                4.                3.               262.
GEM               ID         3.                1.                4.                3.               262.
KING              WA         1.                5.                2.                2.               261.
NEZ PERCE         ID         1.                2.                3.                4.               257.
LEWIS             ID         1.                2.                3.                4.               257.
YAMHILL           OR         2.                2.                3.                3.               249.
KOOTENAI          ID         2.                2.                1.                4.               244.
GRANT             OR         3.                1.                3.                3.               244.
CROOK             OR         3.                1.                3.                3.               244.
OKANOGAN          WA         1.                2.                2.                4.               239.
BENEWAH           ID         1.                2.                2.                4.               239.
KLAMATH           OR         1.                3.                2.                3.               236.
UNION             OR         2.                2.                2.                3.               231.
BOISE             ID         3.                1.                2.                3.               226.
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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION 36 PRIORITY 8 PAGE 2
WEIGHTS PHYSICAL = 31. TRANS = 28. HUMAN = 23. ECOLOGY = 18.

COUNTY	STATE	HUMAN RESOURCE	TRANSPORTATION	ECOLOGICAL	PHYSICAL/CHEMICAL	WEIGHTED SUM
BENTON	OR	3.	2.	2.	2.	223.
LINN	OR	3.	2.	2.	2.	223.
PEND OREILLE	WA	2.	1.	1.	4.	216.
BONNER	ID	2.	2.	1.	3.	213.
WHEELER	OR	3.	1.	3.	2.	213.
FERRY	WA	1.	1.	2.	4.	211.
PIERCE	WA	0.	4.	2.	2.	210.
JEFFERSON	OR	3.	2.	3.	1.	210.
SNOHOMISH	WA	1.	3.	2.	2.	205.
THURSTON	WA	1.	3.	2.	2.	205.
COWLITZ	WA	3.	2.	1.	2.	205.
YAKIMA	WA	0.	2.	3.	3.	203.
CHELAN	WA	2.	2.	2.	2.	200.
COLUMBIA	OR	2.	2.	2.	2.	200.
WASHINGTON	OR	2.	2.	2.	2.	200.
MULTNOMAH	OR	0.	3.	3.	2.	200.
JACKSON	OR	3.	2.	2.	1.	192.
BOUNDARY	ID	1.	2.	1.	3.	190.
SHOSHONE	ID	2.	2.	1.	2.	182.
PACIFIC	WA	2.	2.	1.	2.	182.
CLARK	WA	1.	2.	2.	2.	177.
POLK	OR	1.	2.	2.	2.	177.
MARION	OR	1.	2.	2.	2.	177.
DOUGLAS	OR	3.	2.	1.	1.	174.
JOSEPHINE	OR	3.	2.	1.	1.	174.
TILLAMOOK	OR	2.	1.	2.	2.	172.
SKAGIT	WA	2.	2.	2.	1.	169.
HOOD RIVER	OR	2.	2.	2.	1.	169.
CLACKAMAS	OR	2.	2.	2.	1.	169.
COOS	OR	2.	2.	2.	1.	169.
ADAMS	ID	3.	1.	2.	1.	164.
CLALLAM	WA	1.	1.	1.	3.	162.
MASON	WA	1.	1.	1.	3.	162.
GRAYS HARBOR	WA	1.	2.	1.	2.	159.
LINCOLN	OR	1.	2.	1.	2.	159.
CLEARWATER	ID	2.	1.	1.	2.	154.
WAHKIAKUM	WA	2.	1.	1.	2.	154.
JEFFERSON	WA	1.	1.	2.	2.	149.
IDAHO	ID	1.	1.	2.	2.	149.
WHATCOM	WA	1.	2.	2.	1.	146.
SKAMANIA	WA	2.	1.	2.	1.	141.
CLATSOP	OR	1.	1.	1.	2.	131.
VALLEY	ID	1.	1.	1.	2.	131.

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SORTED WEIGHTED RANKING FOR HAZARDOUS WASTE PROCESSING SITES FOR REGION  36 PRIORITY 8          PAGE 3
                WEIGHTS   PHYSICAL =   31.   TRANS =   28.   HUMAN =   23.   ECOLOGY =   18.

COUNTY          STATE   HUMAN RESOURCE      TRANSPORTATION        ECOLOGICAL        PHYSICAL/CHEMICAL    WEIGHTED SUM

LANE               OR          1.                  2.                  1.                  1.                 128.
CURRY              OR          2.                  1.                  1.                  1.                 123.
SAN JUAN           WA          1.                  1.                  2.                  1.                 118.
KITSAP             WA          1.                  1.                  2.                  1.                 118.
ISLAND             WA          0.                  1.                  2.                  1.                  95.
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APPENDIX N

EXISTING STATE LEGISLATION/REGULATIONS

For each State included in the survey, this appendix contains:

- a descriptive summary of relevant laws, regulations, etc., dealing with transportation, processing, and storage/disposal of hazardous wastes;*
- a table summarizing respective State agency responsibilities for hazardous waste transportation, processing, and storage/disposal; and
- summaries of any law library searches conducted.

This information will be found for each State on the pages indicated below.

	Page
Alabama	A-612
California	A-615
Colorado	A-623
Illinois	A-629
Kansas	A-634
Maine	A-637
Michigan	A-643
Nevada	A-649
New Jersey	A-655
New York	A-657
Oregon	A-661
South Carolina	A-674
Texas	A-677
Vermont	A-680
Virginia	A-683
Washington	A-686

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* In the course of conducting this survey, voluntary opinions were offered by various State agency personnel as to the probable public or State government attitude regarding management of hazardous wastes. These are included as appropriate.

ALABAMA

The Rules and Regulations of the Alabama Air Pollution Control Commission reign supreme, setting standards described as "the toughest in the country".

Although there is no specific reference to hazardous waste disposal in this law, resident engineers say the law can be applied to any situation. Explicit legislation exists on radiation and pesticides only insofar as solids are concerned.

Any county or municipality could pass local ordinances which would constrain a national disposal system of hazardous wastes, and some counties such as Jefferson and Mobile have published sets of standards which for the most part follow the State code. A total of 14 acts were identified in the Alabama Code that could apply to hazardous waste disposal, the nine most relevant of which are included in this report.

In regard to radioactive materials, the State has not provided a public site but requires such materials to be sent to other States for disposal with the exception of the University of Alabama, which operates a disposal site for its radioactive wastes. The inclination of residents to accept the establishment of a site in Alabama as part of a national disposal system appears doubtful.

Other factors in addition to the lack of radioactive material sites include the lack of regulations on explosives and land use. The Air, Water, Solid Waste, and Radiation Divisions of the Department of Health regulate the transportation, processing, and storage/disposal of hazardous wastes for their own respective areas; inland waterway transport is especially controlled by the Alabama Water Improvement Commission. Pesticides are under the control of the Department of Agriculture through licensing, examination, and inspection.

Although it does not possess any regulatory power at present, the Alabama Development Office would be a factor in the establishment of a national site since it is charged with Statewide comprehensive planning. Through contracts, the Alabama Development Office has control over the functions of the Alabama Planning and Development Commission. There is no indication of any lack of cooperation between these agencies; good lateral communication between them can be assumed.

A significant legal confrontation is expected to occur due to a physical restraint involving disposal of chemical wastes by six chemical manufacturing plants in Decatur. The plants have been dumping in a county landfill but the State Health Department has enjoined them to stop without providing an alternative. This constitutes an unusual example in Alabama of local control being overridden by a State agency.

Highlights

- State has not provided public disposal site for radiological materials, which are sent to other States. Law requires disposal on State or Federal land and sites are too costly. Other indications of officials' attitudes are not negative.
- Physical restraints are a current major problem in Decatur where 6 chemical manufacturers are dumping in landfill. The Department of Health says stop, but no alternative site is available.
- The University of Alabama has radioactive waste site for own waste with same regulations as AEC, but there is no State site.
- Air pollution control regulations "toughest in the country" (EPA). Any locality could pass constraining ordinances.
- State legislation authorizes local solid waste regulations. Explicit legilsation exists on radiation and pesticides only.
- Water pollution control regulation standards of Alabama Water Improvement Commission could be used, particularly if inland waterway were used for transport.
- Division of Agricultural Chemicals accounts for all pesticides by licensing and written examinations and inspections and also regulates manufacture.
- Alabama Development Office has contracts with Planning and Development Commission which gives some control of planning and influence on Federal programs. They would be involved in any implementation through water quality management plans for State's river basins. No indication given of excessive lack of interagency cooperation. No indication given on lateral communication.
- State adopted AEC, DOT regulations and set own high air standards.

AGENCY RESPONSIBILITY

ALABAMA	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
DEPARTMENT OF HEALTH AIR WATER SOLID WASTE RADIATION	ALL FOUR DIVISIONS LISTED BELOW HAVE RULES AND REGULATIONS WHICH WOULD TEND TO CONSTRAIN ACTIVITY IN THESE THREE CATEGORIES. THE AIR AND SOLID WASTE DIVISIONS TEND TO GIVE CONSIDERABLE AUTHORITY TO COUNTIES AND CITIES.		
PUBLIC SERVICE COMMISSION	NONE	NONE	NONE
DEPARTMENT OF AGRICULTURE AND INDUSTRIES	ONLY REQUIRE THAT PESTICIDES BE SHIPPED IN FACTORY SEALED CONTAINERS	HAVE AUTHORITY TO INSPECT AND CAUSE CORRECTIVE ACTION WITH MANUFACTURE OF PESTICIDES - SAME PROBABLY WOULD APPLY TO PROCESSING WASTE	MAJOR PROBLEM NOW IS HOW AND WHERE TO DISPOSE OF USED CONTAINERS - DRUMS AND PLASTIC BAGS. HAVE AUTHORITY TO INSPECT PESTICIDE STORAGE FACILITIES.
ALABAMA DEVELOPMENT OFFICE	NO REGULATORY POWERS AT PRESENT. HOWEVER, THEY ARE LEGALLY CHARGED WITH STATEWIDE COMPREHENSIVE PLANNING AND, THEREFORE, WOULD PLAY A ROLE IN IMPLEMENTING A HAZARDOUS WASTE MANAGEMENT SYSTEM.		
DEPARTMENT OF CONSERVATION	DID NOT CONTACT		
STATE HIGHWAY DEPARTMENT	DID NOT CONTACT		
DEPARTMENT OF PUBLIC SAFETY	DID NOT CONTACT		

CALIFORNIA

State of California legislation is already well organized, strongly favoring local or regional control. This concept is generally inconsistent with the implementation of a national disposal system for hazardous wastes.

EPA has not approved California's plan of statewide control of environmental problems; the State plan is merely a compilation of local or regional plans. The newly created Office of Planning and Research, an agency within the Governor's Office, was formed to assist State and local agencies in their planning and has no control functions. The Governor is charged with preparing a comprehensive State Environmental Goals and Policy Report every four years. Therefore, the Office of Planning and Research probably comes the nearest to fulfilling the role of a primary agency even though its function is strictly advisory.

Areas in which regulation is lacking in California include the processing and disposal of explosives and statewide zoning pertaining to land use; also, there are no existing facilities for disposal of radioactive waste material.

Although there currently is no statewide policy for solid waste disposal a State Solid Waste Management Board within the Resources Agency has been formed and charged with development of a plan by 1975. Solid wastes now are regulated loosely by the State and Regional Water Quality Control Boards of which there are nine. California's interstate water quality standards have been approved by EPA.

A single air quality plan is required in basin areas, so designated by the State Board. The Coastal Zone Conservation Commission is charged with planning for regions bounded by the mountains and the sea.

The key to control of the environment in California rests in the hands of the municipalities, counties, or regions and poses a serious obstacle to establishment of a national site. A strong introspective attitude in combination with land use control determined by geographical boundaries reinforces the control of air and water disposal by localities. The prime future statewide influence would probably come from the Governor's Office via the Office of Planning and Research.

Control of transportation and safety standards by State agencies presently forms the only factor consistent with a national site. DOT regulations have been adopted.

Highlights

- State legislation is oriented to local determination. Whether or not this local conceptualization of implementation is consistent with a national plan is questionable. EPA has not approved California's implementation plan.
- A single air quality plan is required in areas designated by State Board as a basin. Coastal Zone Conservation Commission plans for regions bounded by sea and mountains.
- State plan is compilation of various local plans. Municipalities currently have existing facilities individually regulated, air standards are set by county on regional boards. Water standards are regional. Pesticide regulation is in process.
- Safety is extensively regulated by the Department of Industrial Relations, the State Highway Patrol and the State Fire Marshall.
- Local character of new legislation would imply a personal basis for interagency cooperation, with little jurisdictional dispute.
- Constraint on land use seems clearly defined through geographical organizations (basins, regions, districts). Attitude is definitely introspective.
- Transportation permits, licenses pertaining to size of shipment, safety, types of cargo are issued. DOT regulations adopted.
- Differing interstate standards should be similar to other States adopting DOT regulations.
- Wide diversity of agencies has a definite local or regional flavor.
- There are nine regional water quality control boards and a new Office of Planning and Research in the Governor's Office. State requires local agencies to establish planning agency.
- California Environmental Act is similar to National Environmental Protection Act.

AGENCY RESPONSIBILITY

CALIFORNIA	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
HIGHWAY PATROL	DOT REGULATIONS FOR TRANSPORTATION OF HAZARDOUS MATERIALS HAVE BEEN ADOPTED.[2]		
FIRE MARSHALL	HAS ADOPTED REGULATIONS FOR TRANSPORTATION OF FLAMMABLE LIQUIDS		
HIGHWAY PATROL	HAS ADOPTED REGULATIONS FOR TRANSPORTATION OF EXPLOSIVES. EXPLOSIVES CANNOT BE TRANSPORTED OVER CERTAIN HIGHWAYS. EXTENSIVE REGULATIONS HAVE BEEN ADOPTED FOR TRANSPORTATION OF HAZARDOUS MATERIALS ON TOLL ROADS AND BRIDGES.		
PUBLIC WORKS	ALL HAULERS OF LIQUID WASTE MUST REGISTER WITH THE STATE WATER RESOURCES CONTROL BOARD		
RESOURCES AGENCY		COUNTY AND REGIONAL AIR POLLUTION BOARDS HAVE SET EMISSION AND AMBIENT AIR QUALITY STANDARDS. PERMITS FOR NEW OR ALTERED EQUIPMENT CAN BE REQUIRED. REGIONAL BOARDS ALSO REGULATE WATER QUALITY. A DISCHARGE PERMIT FROM A REGIONAL BOARD IS REQUIRED.	WASTE DISPOSAL SITES ARE BEING CATEGORIZED INTO THREE GROUPS. HAZARDOUS WASTES ARE GENERALLY LIMITED TO CLASS ONE SITES. SPECIFICATION FOR SUCH SITES HAVE BEEN ADOPTED.
DEPARTMENT OF IRRADIATION			THE DEPARTMENT HAS ISSUED REGULATIONS FOR THE DISPOSAL AND TRANSPORTATION OF RADIOACTIVE MATERIAL. DOT REGULATIONS HAVE BEEN ADOPTED.
DEPARTMENT OF AGRICULTURE			
DEPARTMENT OF INDUSTRIAL RELATIONS		EXTENSIVE REGULATIONS HAVE BEEN ADOPTED TO PROTECT WORKERS FROM HAZARDOUS MATERIALS	REGULATIONS FOR HANDLING AND DISPOSAL OF PESTICIDES AND THEIR CONTAINERS ARE IN THE PROCESS OF BEING ADOPTED
MISCELLANEOUS		THE CALIFORNIA ENVIRONMENTAL QUALITY ACT OF 1970 IS SIMILAR TO NEPA. IMPACT STATEMENTS ARE REQUIRED.	CALIFORNIA HAS JOINED WITH NEVADA IN CREATING THE CALIFORNIA-TAHOE REGIONAL PLANNING AGENCY. IT MAY ENFORCE AN INTERIM PLAN FOR LAND DEVELOPMENT IN THE LAKE TAHOE AREA. CITIES AND COUNTIES ARE EACH AUTHORIZED TO ZONE. SHORELINE DEVELOPMENT AROUND SAN FRANCISCO BAY MUST BE APPROVED BY THE SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION THE COASTAL ZONE CONSERVATION COMMISSION IS CURRENTLY PREPARING A LAND-USE PLAN FOR THE PACIFIC OCEAN COAST. BETWEEN 1973 AND 1976 A PERMIT IS REQUIRED FOR DEVELOPMENT BETWEEN THE SEAWARD JURISDICTIONAL LIMIT AND 1000 YARDS INLAND.

[1] REGULATIONS ADOPTED ARE 49CFR 170-190, 14CFR 103, AND 46CFR 17.

[2] 49CFR 171, 172, 177, 178.

Law Library Search Findings

Solid Waste

California currently has no statewide policy for solid waste disposal. The newly created State Waste Management Board within the Resources Agency is to adopt a plan by January 1, 1975, Government Code §66770. Primary responsibility for adequate solid waste disposal is to rest with local governments - §66730. Each county is to prepare a plan by January 1, 1976, §66780. The State Department of Health is directed to "prepare and submit minimum standards for solid waste handling and disposal" to the Board by January 1, 1975, for inclusion in the State plan.

At the present time solid waste disposal is essentially regulated by the State and Regional Water Quality Control Boards. A description of their activities is included on pages 41-44 in the Hazardous Waste Disposal Survey conducted by the California State Department of Public Health. The actual regulations are in subchapter 15 of the water regulations. The authority for this regulation is questionable. Section 14040 of the Water Code, upon which authority is placed, specifies that regulations are to be adopted for "liquid" waste. The State Board presumably is relying on §13050 (d) which defines waste as including solids.

Water Quality Control

The State Water Resources Control Board coordinates all water quality activities. The nine regional water quality control boards are required to adopt water quality plans - Water Code §13241. Permission for waste discharge must be obtained from the regional boards - §13263. Regional Boards have cease and desist powers - §13301. Interstate water quality standards have been approved by EPA.

Air Pollution

A summary of the effect of California air pollution law relating to hazardous wastes is in the California Hazardous Waste Disposal Survey on pages 44-47.

Discharge of injurious or annoying material into the air is prohibited by statute §24243.

Air control boards can make all necessary regulations, Health and Safety Code §24260, and order abatement, §24605. Two or more counties may form a regional district - §24330, §39301.

Land Use Control

The State Office of Planning is a division of the Department of Finance - Government Code §65013.2. Its functions, other than the maintenance of a comprehensive state development plan, are limited to advising and coordinating activities of local planning boards. The State plan is a compilation of local plans - §65015.

The newly created Office of Planning and Research is in the Governor's Office - §65037. This body has no control functions, but was formed to assist State and local agencies in their planning process - §65040.

The Governor of California is charged with preparing every four years a comprehensive State Environmental Goals and Policy Report - §65041.

Regional planning districts are authorized by vote of 2/3 of the cities and counties within a district - §65061.3. Each district may maintain a comprehensive regional plan - §65065.1.

In the Lake Tahoe area, a single regional planning agency composed of cities and counties in both California and Nevada has been created - §67040. An interim plan, §67073, and a comprehensive regional plan are required - §67070. The agency is to adopt regulations to effectuate the plan - §67100. The regulations are to contain standards, including specific standards for solid waste disposal, shoreline development, and waste disposal in shoreline areas - §67100. The agency is to police the region to ensure compliance with the regulations - §67105.

Every city and county in California is required to have its own planning agency - §65100. Each agency is required to maintain a general plan - §65101. Plans must include a wide variety of elements - §65302. Specific plans for a limited area are also authorized - §65450.1.

Every city and county was required to submit to the State Resources Agency by June 30, 1972, an "open-space plan for the comprehensive and long-range preservation and conversation of open space land within its jurisdiction" - §65563.

Legislative bodies of cities and counties may establish an area planning commission - §65601 - or a district planning district - §66140. Cities and counties are given broad zoning powers in §65850. Zoning ordinance must be consistent with the general plan by January 1, 1973.

A San Francisco Bay Conservation and Development Commission has been created - §66620. It has prepared the San Francisco Bay Plan which is a "comprehensive and enforceable plan for the conservation of the water of the San Francisco Bay and the development of its shoreline" - §66603. The Commission's permission must be obtained before filling, extraction of materials, or substantial changes in structures can be performed - §66632.

In the November 7, 1972 election California voters passed the Coastal Zone Conservation Act. The Initiative measure creates a Coastal Zone Conservation Commission and six regional commissions - Public Resources Code §27000. The Commission is to submit to the legislature a land use plan for land between the seaward limites of State jurisdiction and the peak of the coastal mountain range - §27300. Between 1973 and 1976, a permit will be required for development between the seaward jurisdictional limit and 1,000 yards inland - §27400.

Nuisances

Legislation relating to nuisances begins at §3479 of the Civil Code. Public and private nuisances are defined and remedies provided. Activities authorized by statute cannot be deemed a nuisance - §3482.

Radiation Control

The State Department of Public Health administers disposal and transportation of radioactive material, Health and Safety Code §26500, §25651.

Disposal of radioactive material which will result in significant contamination of the environment is prohibited. The Department can prohibit any activity with radioactive wastes if there is danger of contamination - §25603. The Department is also charged with monitoring storage, packaging, transportation, and loading of radioactive waste - §25606.

Regulations have also been promulgated for disposal of radioactive material. Concentration limits have been adopted for release into air or water - Title 17, §30269. Disposal in a sewer system is permitted if the waste is dispersible in water and does not exceed concentration limits - §30287. Burial is permitted if radioactive material is appropriately spaced and within concentration limits - §30288. The following restriction should be noded:

> *The department will not approve any application for a license to receive radioactive material from other persons for disposal on land not owned by the State or Federal Government - §30288 (b).*

Regulations for intrastate transportation of radioactive material have also been adopted by the Department. The regulations require conformity to 49 C.F.R., Parts 170-190; 14 C.F.R., Part 103; and 46 C.F.R., Part 146 - Title 17, §30373.

Transportation of Hazardous Materials in General

The State Highway Patrol is authroized by §34500 of the Vehicle Code to regulate operation of vehicles containing hazardous materials as defined in 49 C.F.R., 172, 173. The Patrol has adopted 49 C.F.R., 171, 172, 177, 178, Administrative Code, Title 13, §1222 (a). Some additional regulations supplement the DOT regulations. Transportation of radioactive materials, flammable liquids, explosives, and other materials specifically provided for do not come under the authority of the Highway Patrol - §34500.

The Department of Public Works has extensive regulations governing transportation of hazardous materials on California toll roads and bridges. California Administrative Code, Title 21, Chapter 2, Subchapter 1.

All haulers of liquid waste, except sewage, fertilizer, or radioactive material, must be registered with the State Water Resources Control Board, Water Code §14020.

Transportation and Storage of Explosives

Legislation applicable to intrastate transportation of explosives in quantities greater than 1,000 pounds is in §36000 of the Motor Vehicle Code. Transportation of quantities less than 1,000 pounds is in §12000 of the Health and Safety Code.

A license from the State Highway Patrol is required for transportation of explosives. The Highway Patrol is given extensive authority to designate routes and inspect vehicles. Equipment requirements are also designated - Motor Vehicle Code §31610.

The State Fire Marshal is authorized to adopt regulations governing transportation of flammable liquids - §34000. The regulations are found in subchapter 11 of Chapter 1, Title 19, California Administrative Code. The regulations are quite detailed.

Pesticides

The California Department of Agriculture establishes regulations for handling of agricultural chemicals and the empty containers.

A recent amendment to the Agriculture Code makes it unlawful "for any person to store, transport, handle, or dispose of any economic poison or of any container which holds or has held such economic poison, except in compliance with rules and regulations of the director", Agriculture Code §12991. Hearings were held early in November 1972 on proposed regulations for handling and disposal of pesticide containers. Economic poisons are broadly defined to include most all agricultural chemicals - §12753.

Industrial Safety

The California Department of Industrial Relations, through its Division of Industrial Safety, has issued extensive regulations to protect workers from hazardous materials. Regulations exist for radiation and radioactivity, control of hazardous substances, and explosives and fireworks. Further discussion is on page 47 of the Hazardous Waste Disposal Survey.

COLORADO

The most anti-Federal-control attitude of any State among the 16 surveyed is presented by Colorado, which is unique in that noting existing regulation is easier than noting its nonexistence. This can probably be traced to the development of the State and its political structure under the influence of extreme topography, resulting in local determination. The Colorado Land Use Commission policy is that "the decision-making authority ... shall be at the lowest level of government possible". That agency would probably be the key to any Statewide implementation of a hazardous waste management system in the future, as it is charged with development of an overall plan for the State.

However, existing legislation authorizes county and city governments to override any regional plans by a two-thirds vote; this would be a continuing obstacle for implementation of a national disposal system unless the State performed a complete turnabout in its political heritage/philosophy and rescinded such legislation.

Colorado is, again due to its history (particularly involving mines), different from many of the other States surveyed in that it has regulations for disposal of solid wastes. However, regulation of air and water quality is lacking, as it also is for explosives, pesticides, safety, and the transportation, processing, and storage of radioactive materials. There are regulations for radioactive disposal (by burial in special landfills) but no specific disposal sites for either radioactive or other hazardous waste materials. DOT transportation regulations have been adopted; however, cities and counties again can override these for areas within their jurisdiction.

The existence of large leases and mining claims creates a stronger flavor of deference to private interests than is observed in any of the other 16 States surveyed; for instance, the approval of the Land Use Commission is not required for construction of a private waste processing or disposal site.

Highlights

- "...The decision-making authority as to the character and use of land shall be at the lowest level of government possible." Colorado Land Use Commission policy is to prepare overall plan. Regional plans can be overridden by county and city governments. Approval of Commission is not required for construction of a private waste processing or disposal site. Local/individual concept seems inconsistent with Federal program.

- Severe topography of much of the State would substantiate the apparent local flavor of implementation.

- There are no radioactive waste disposal sites. Radioactive material is now placed in special landfills. Regulations have been adopted, but no specific regulations on hazardous waste materials.

- DOT safety regulations have been adopted and are enforced by the Public Utilities Commission.

- In interagency cooperation, what limited regulation exists seems clearly defined as to whose jurisdiction prevails.

- An interim plan for State land use was completed in December 1972. Existence of large leases and claims of mining property may be unique for the State and may be a basis for deference to private interests in waste disposal.

- DOT transportation regulations have been adopted, but towns and cities can override these inside their corporate limits.

- Cities, towns, and counties may set stricter air standards than the State. EPA has approved Colorado air standards except for motor vehicles. Interstate water standards have been approved and DOT standards adopted.

- Local emphasis in political control, but State can issue cease and desist orders with Governor's concurrence to protect the general public welfare.

- State has adopted fewer of the DOT guidelines than any other of the 16 States surveyed.

Law Library Search Findings

Solid Waste

Administration of solid waste laws is within the State Department of Health. Regulations adopted by the Department of Health became effective April 1, 1972.

Disposal sites in unicorporated areas must be approved by the local county commissioners, CRS 36-23-2. The Department of Health issues a recommendation regarding proposed sites to the commissioners - CRS 36-23-2. Approval cannot be granted by county commissioners if the Department of Health does not concur - CRS 36-23-5. Sites must conform to the comprehensive county land use plan - CRS 36-23-4 (3).

AGENCY RESPONSIBILITY

COLORADO	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
PUBLIC UTILITIES COMMISSION	ADOPTS AND ADMINISTERS SAFETY REGULATIONS FOR HAZARDOUS MATERIALS TRANSPORTED BY WATER OR HIGHWAY. DOT REGULATIONS HAVE BEEN ADOPTED.[1]		
DEPARTMENT OF HEALTH		ADOPTS AND ADMINISTERS DISCHARGE AND AMBIENT AIR[2] AND WATER[3] STANDARDS. ALL WATERS ARE CLASSIFIED INTO FOUR CLASSES. EACH CLASS HAS AN ACCEPTABLE TOXIC MATERIAL CONCENTRATION LIMIT.	PERMITS REQUIRED TO DISPOSE OF HAZARDOUS WASTES UNDERGROUND.[4] AIR EMMISSION PERMITS ARE REQUIRED FOR NEW OR ALTERED EQUIPMENT.[5] RADIOACTIVE MATERIALS CAN ONLY BE DISPOSED OF IN SPECIALLY DESIGNATED LANDFILLS. THE DEPARTMENT IS AUTHORIZED TO ACQUIRE LAND EXCLUSIVELY FOR DISPOSAL OF RADIOACTIVE WASTE BUT HAS NOT DONE SO.[6] NO SPECIFIC REGULATIONS FOR HAZARDOUS WASTE DISPOSAL.
MISCELLANEOUS	CITIES MAY REGULATE STORAGE AND TRANSPORTATION OF VARIOUS HAZARDOUS MATERIALS WITHIN THEIR BOUNDARIES.[7]		CITIES AND COUNTIES ARE AUTHORIZED TO ZONE. THE COLORADO LAND USE COMMISSION IS CURRENTLY DRAFTING A "TOTAL LAND USE PLANNING PROGRAM FOR THE STATE". PRIOR TO COMPLETION, THE GOVERNOR IS AUTHORIZED TO VETO CERTAIN LAND ACTIVITIES.

[1] COLORADO HAS ADOPTED 49CFR 173-178, 397

[2] CRS 66-31

[3] CRS 66-28

[4] CRS 66-28-9

[5] CRS 66-31-12

[6] CRS 66-26-3

[7] CRS 139-32-54

Radioactive materials can only be disposed of in specially designated sites. Section 3 (1) (d) (Regulations).

"Hazardous material and toxic substances" are defined as "liquids or solids which can be dangerous to man, animal, and plant life unless properly neutralized". Previous regulations required hazardous and toxic wastes to be neutralized before disposal. At the present time, disposal is permitted if air and water quality standards can be met. There is no specific regulation relating to disposal of hazardous wastes.

Air Pollution

Air pollution control is administered and enforced by the Air Pollution Control Commission in the State Department of Health, CRS 66-31-4, 66-31-13. Cities, towns, counties, and combinations thereof are authorized to adopt and enforce stricter emission standards than State standards, CRS 66-31-25. The Commission is authorized to adopt emission and ambient air quality standards, CRS 66-31-7, -8. A variance board exists to grant variances for good cause, CRS 66-31-15. EPA has fully approved the Colorado air implementation plan, except for motor vehicle implementation. The approved portions will have to be reeaxmined, however, to see if they contradict the "nondegradation" result ofthe recent Sierra Club court case.

Water Pollution

Water pollution control is administered by the Water Pollution Control Commission within the Colorado State Department of Public Health. The Commission is authorized to adopt water quality standards, CRS 66-28-8 (1), and discharge standards, CRS 66-28-8 (2). Interstate standards have been adopted.

Written permits are required to dispose of radioactive or toxic wastes "underground in liquid or explosive form", CRS 66-28-9 (2). The Commission must find that there will be no harm resulting.

Notice of plans to operate a system to dispose of wastes must be given to the Commission, CRS 66-28-12.

Land Use Control

County and regional planning authorities are authorized in CRS 106-2-2, 2-4 and are required to prepare waste plans. Regional plans are not binding on cities or counties, CRS 106-2-5 (b). A 2/3 vote can override the regional planning authority when zoning changes for sites greater than 20 acres are in question, CRS 106-2-9(2)(c).

Approval of the regional planning authority is apparently not needed for construction of a private waste processing or disposal site, CRS 106-2-9(1)(a). Zoning in unincorporated areas is authorized, CRS 106-2-10.

The Division of Planning within the State Department of Local Affairs acts as an information source and advisory body for local governments, CRS 106-3-2.

In 1971, the Colorado Land Use Commission was created, CRS 106-4-2. The legislative declaration accompanying the article states that "land use, land use planning, and quality of development are matters in which the State has responsibility for the health, welfare, and safety of the people of the State and for the protection of the environment of the State", CRS 106-4-1(2). The Commission is charged with developing a "total land use planning program" for the State, CRS 106-4-3 (1) (a).

The Commission is directed to "recognize that the decision-making authority as to the character and use of land shall be at the lowest level of government possible", CRS 106-4-3(1)(b). It can, however, issue a cease and desist order with the Governor's concurrence to the person in control of any activity "which constitutes a danger of irreparable injury, loss, or damage of serious and major proportions to the public health, welfare, or safety", CRS 106-4-3(2)(a).

Radiation

The State Department of Public Health is designated as the radiation control agency of Colorado, CRS 66-26-3. It is authorized to acquire sites for concentration, storage, and/or permanent disposal of radioactive materials, CRS 66-26-3(7) (a). The site and radioactive material are to be permanently owned by the State, CRS 66-26-3(7)(h). Licensees may be authorized to operate disposal sites, CRS 66-26-3(7)(b). The Department of Health indicates that no sites are presently being operated. Radioactive material is going into specially designated landfills. Regulations for disposal of radioactive material have been adopted. Rules and regulations pertaining to radiation control, RH 4.10-4.16.

Pesticides

Colorado requires registration of pesticides but does not have specific regulations relating to transportation or disposal.

Transportation of Hazardous Material

The Colorado Public Utilities Commission has adopted Department of Transportation regulations in Title 49 of the Code of Federal Regulations, Parts 173-178 and 397.

Towns and cities are authorized to regulate or prevent the storage and transportation of combustible or explosive material within their corporate limits, CRS 139-32-1(54).

Nuisances

"Towns and cities are authorized to declare what shall be a nuisance and to abate the same and to impose fines upon parties who may create, continue, or suffer nuisances to exist", CRS 139-32-1(58).

A local board of health may destroy and abate nuisances which in "its opinion may be injurious to the health of the inhabitants within the town, city, or county", CRS 66-3-13. The State Department of Health is authorized to act if the local board does not, CRS 66-3-2.

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ILLINOIS

If the environmental regulations of all the States of the nation were as well oriented along Federal guidelines as are Illinois', establishment of a national hazardous waste management system would be nearly accomplished. The legislation/ regulations existing within this State are based on a 1966 adoption that followed Federal guidelines closely; as such, the present body of regulation is well defined and already operational.

The few areas still not regulated include the disposal, processing, and storage of explosives and the safe handling of hazardous materials. There are no facilities in existence for handling hazardous materials other than radioactive ones. Illinois is one of five States with an operational disposal site for radiological wastes--a site located on public land but operated by a private firm.

One potential problem involves groundwater pollution from solid waste landfills; this is under the technical supervision of the Illinois Geological Survey. Another relative weakness is the poorly defined or regulated area of transportation, in which DOT regulations have not been adopted. This is paradoxical in that most other States, many of which are strongly local in attitude, have already adopted these regulations.

Another potential problem area is that of differing interstate standards, because Illinois standards exceed those of the Federal guidelines.

One of the most significant facets of Illinois' adoption of EPA standards is that the State agency can overrule local zoning and siting decisions and also can investigate industries to determine whether they are sources of pollution and what their methods of control are.

Highlights

- Attitude and inclination are favorable. Existing and/or new legislation designed around Federal guidelines is already fully organized and operational.

- Some groundwater pollution problems exist.

- Illinois is one of five States with radioactive waste disposal sites operated by private firms on State land. Department of Public Health regulates radioactive wastes, all other wastes are regulated by State Environmental Protection Agency.

- DOT safety regulations have not been adopted and there are no rules and regulations other than placards and licenses.

- Interagency cooperation appears clearly defined and viable.

- Good attitude of State agencies toward hazardous waste management system exists. Voters must decide on land use through referendum. There is local government disposal via EPA regulations (both judicial and legislative). 1966 Illinois law used for EPA.

- Transportation is not very well defined or regulated.

- Illinois State standards generally exceed Federal interstate standards.

- Political structure is well defined and operational.

- State used Federal guidelines in adopting 1966 State legislation. Federal regulations are followed on transport of pesticides.

Law Library Search Findings

In reviewing the legislation a number of key terms were located in the index of the State codes. A more thorough search was then performed in reviewing the actual laws. The following is the list of terms used:

1. Wastes
2. Industrial Wastes
3. Pollution of Water
4. Sanitation
5. Economic Poison
6. Disposal
7. Natural Resources
8. Environmental Protection Agency
9. Environment
10. Interstate Sanitation Commission
11. Department of Agriculture
12. Ecology
13. Air Pollution
14. Chemicals
15. Zoning
16. Radioactive Materials
17. Department of Highways
18. Water Quality
19. Garbage and Refuse
20. Insecticides, Pesticides
21. Sewage

22. Utilities
23. Motor Vehicles
24. Ionizing Radiation
25. Navigable Waters and Shorelines
26. X-Ray Equipment
27. Water
28. Dangerous Substances
29. Hazardous Substances
30. Conservation
31. Health
32. Municipal Pollution Control
33. Planning Commission
34. State Land Use and Development
35. Sanitary Landfill
36. Soil Conservation
37. Transportation

Unless specifically stated, it may be assumed that restraints were not found under the terms searched. This list is by no means exhaustive or comprehensive, nor does it assume that restraints cannot be found under different terms or sections of the State code.

Restraints are few as most of the legislation is stated in very general terms, with provisions for unusual or exceptional circumstances that may arise.

Recent legislation which has not yet been incorporated into the State code but which has been passed by the General Assembly is referred to as a Public Act (PA).

Transportation

Registration is a prerequisite for interstate commerce. 18-303. It is unlawful to transport misbranded hazardous substances. 11-1/2:262. Transportation of nitroglycerin is prohibited. PA 77-2274. Carrier of hazardous substances must show records on request. 11-1/2:262.

Industrial Waste Disposal

The State has the right to charge individuals for such disposal. 42:421.

Radiation Installations

Must be registered with the Director of the Department of Public Health. 111-1/2:195. Specifications for amounts of radiation considered harmful are given. 111-1/2:196. Prohibits exposure to ionizing radiation. 111-1/2:212. Persons disposing of radioactive materials must keep records for Department of Health. Provides for leasing of lands, building and sites for purposes of operating a site for concentrating radioactive wastes. 111-1/2:230.4. Responsibility to public for safety from radiation. 111-1/2:230.6.

Land Use

Use of lands for conserving water, soil, etc. must be put before the voters in the form of a referendum. Three-quarters approval is necessary. 5:128.

Industrial Pollution Control

The State is authorized to acquire land as it sees necessary for the construction of a pollution control facility. PA 77-2159. Methods of financing are outlined in this section.

Waste Disposal Districts

Power is vested in local government to dispose of solid wastes in compliance with EPA regulations. 85:1654.

Water Pollution

The State code expressly forbids the discharge of polluting materials into Lake Michigan. 19:61a. Prohibits discharge of pollutants directly or indirectly into natural waterways. 85:1706.

Pollution Investigation

Power is vested in the attorney general to investigate any pollution of air, water, or land. 14:12.

Sewage Disposal

Power is vested in the county to provide for the disposal of sewage, refuse and other objectionable wastes within the borders of the county. 34:3111.

Labeling

Hazardous substances must be labeled as such. 111-1/2:252-11. If not, they are subject to seizure. 111-1/2:255.

Radioactive Wastes

The State government can purchase, lease, accept, or acquire lands, building, and grounds where radioactive wastes can be disposed. 127:55.34.

Radiation

Registration of radioactive materials is required. PA 77-210.

Sanitary Landfill

Disposal of refuse without creating hazards. (EPA Act) Must file 10 day notice for operating. PA 77-1948.

EPA Act

No emission is allowed which will cause air pollution. PA 77-1684. No emission is allowed which will cause water pollution. PA 77-1605.

EPA

Sets up standards for operation of disposal sites. PA 77-1948.

EPA Agency

Defines and implements environmental standards. 111-1/2:1005.

Refuse Disposal

No person shall conduct refuse disposal without permit. 111-1/2:1021.

Economic Poisons

Must be registered before they can be transported. PA 77-2168.

KANSAS

Through vague, ill-defined legislation, Kansas is currently waiting for implementation of a national disposal system before designing its own State organization to fit the Federal guidelines. This is in contrast to other States which have forged ahead with their own State regulations designed around local or regional control. However, Kansas has a study under way in conjunction with Federal agencies to determine how best to process, transport, and dispose of hazardous chemical wastes.

Kansas lacks regulations in land use and industrial safety; there are no existing facilities for disposal of hazardous wastes, nor are disposal facilities of any kind contemplated following a serious failure in public relations in which the public became aroused by misinformation (or lack of information) regarding a radioactive disposal site in an underground salt mine at Lyons, Kansas. The citizenry would definitely vote down any proposal at the present time, according to officials.

Another potential stumbling block in the way of implementation of a hazardous waste management system is a confusing overlap of jurisdiction among the State agencies; e.g., the Department of Health regulates disposal of radioactive wastes, while the law gives similar authority to eight other agencies.

A change in the physical aspects normally presenting some constraint to implementation of a NDS has occurred with the widespread development of surface water entrapment along river valleys in central and southern Kansas. Thus groundwater no longer is the prime water source. This should alleviate the problem of disposal of wastes in landfills.

Cities and counties can enact their own regulations if these are more stringent than State regulations; this is no surprise, considering the traditional independence of the citizens of the State, and it provides an insight into the public attitude toward establishment of a national disposal system--such an implementation would require that extensive groundwork be laid in the public relations/information area before being readily accepted.

Highlights

- Agencies are waiting for EPA before establishing legislation, or conducting studies in conjunction with EPA or HUD (cooperative/anticipative).

- Salt mine disposal site for radioactive burial at Lyons caused public outcry. There is a strong groundwater monitoring agency. Surface water capacity increased with new systems of reservoirs so that groundwater sources are no longer the prime water source.

- No well defined regulations exist. Very broad legislation provides basis for regulation. There are no facilities and none are contemplated after Lyons. State authorizes underground and surface storage and disposal, however.

- Normal safety permitting and licensing by State Highway Department.

- There are large landowners in western portion of State. Farmers are noted for independence and conservatism. Local regulation is sanctioned if State standards are exceeded.

- Transportation regulations are not fully developed.

- Diversity of agencies causes some confusion in administration (overlap of responsibility).

- Political structure could lead to jurisdictional disputes in area of radioactive disposal regulated by Department of Health. Eight other agencies make recommendations on legislation and administration.

AGENCY RESPONSIBILITY

KANSAS	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
BOARD OF AGRICULTURE	THE BOARD HAS THE AUTHORITY TO REGULATE THE MANUFACTURE, TRANSPORTATION, STORAGE, AND USE OF PESTICIDES. THERE IS NO LEGISLATION OR REGULATION ON THE SPECIFIC SUBJECT OF HAZARDOUS WASTE DISPOSAL.		
DEPARTMENT OF HEALTH AIR WATER SOLID WASTE RADIATION	ALL FOUR DIVISIONS LISTED BELOW HAVE THE RESPONSIBILITY AND AUTHORITY TO CONTROL THE TRANSPORTATION, PROCESSING, STORAGE, AND DISPOSAL OF HAZARDOUS WASTE AS IT AFFECTS THEIR ENVIRONMENTAL AREAS.		
STATE HIGHWAY DEPARTMENT	ISSUES PERMITS FOR HAULERS OF HAZARDOUS WASTE		

MAINE

The State Planning Office sees little likelihood that the Maine Coastal region will support any sites for hazardous waste disposal; the inclination of the State toward establishment of a national disposal site appears to be firmly negative.

The Department of Environmental Protection is the key agency in future legislation controlling hazardous waste disposal; in it are the Bureaus of Water Quality Control, Air Quality Control, and Land Quality Control. However, most of the effective regulation that exists presently is administered through the Public Utilities Commission via its licensing and permitting activities.

The State has regulations on the transportation, disposal, processing, and storage of radioactive materials; however, no facilities exist for disposing of radioactive or other hazardous materials. Lacking regulation are the licensing of solid waste disposal sites, air and water quality emissions, processing, and storage of pesticides.

The State may establish regulations via licensing that could influence the movement of nuclear materials.

Highlights

- Municipalities and counties can regulate the operation of all vehicles in public ways and even set licensing and rate requirements if these do not conflict with the Public Utilities Commission.
- Public Utilities Commission governs licensing, permits, rates and extent of liability for carriers.
- Licensing of all waste discharges is required by State, as well as location of solid waste disposal areas.
- State regulations specify that all sites must be located at least 300 feet from the shore of any classified water body.
- State regulations on employee welfare exist at processing plants and all working environments.
- Coastal Zoning Plan is currently being developed.
- State Planning Office sees little likelihood that the Maine Coastal region will support any sites for hazardous waste disposal.

AGENCY RESPONSIBILITY

MAINE	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
DEPARTMENT OF PUBLIC SAFETY	ISSUES AND ENFORCES RULES AND REGULATIONS PERTAINING TO THE TRANSPORTATION OF HAZARDOUS MATERIALS AND PARTICULARLY EXPLOSIVES AND FLAMMABLES		ESTABLISHES RULES FOR THE STORAGE OF FLAMMABLES AND EXPLOSIVES
PUBLIC UTILITIES COMMISSION	REQUIRES ALL INTRASTATE COMMON CARRIERS TO PLACARD HAZARDOUS CARGO AND TO HAVE A BILL OF LADING AVAILABLE AT ALL TIMES DURING SHIPMENT. HAS NO CONTROL OVER PRIVATE CARRIERS. INTERSTATE CARRIERS MUST CONFORM TO ICC RULES AND REGULATIONS		
DEPARTMENT OF HEALTH AND WELFARE	REQUIRES LICENSING FOR ALL SOURCES OF RADIATION AND MAY ESTABLISH RULES AND REGULATIONS WHICH COULD INFLUENCE THE MOVEMENT OF NUCLEAR OR ATOMIC MATERIALS	ESTABLISHES RULES AND REGULATIONS PERTAINING TO THE SAFETY AND HEALTH OF WORKERS HAS THE RESPONSIBILITY TO PROTECT THE PUBLIC FROM THE HAZARUS OF RADIATION. ESTABLISHES RULES AND REGULATIONS AND LICENSES SOURCES OF RADIATION.	
DEPARTMENT OF AGRICULTURE	MAY INSPECT AND REQUIRE PLACARDING OF THE INTRASTATE MOVEMENT OF HAZARDOUS MATERIALS REGISTERS ALL ECONOMIC POISON DELIVERED FOR TRANSPORTATION . . . REQUIRES PROPER LABELING		
DEPARTMENT OF ENVIRONMENTAL PROTECTION		ESTABLISHES AMBIENT AIR QUALITY STANDARDS LICENSES SOURCES OF EMISSIONS AND ISSUES ORDERS TO ABATE ESTABLISHES STANDARDS FOR WATER QUALITY REGULATES THE LOCATION OF DEVELOPMENTS (INCLUDING INDUSTRIAL) COVERING MORE THAN 20 ACRES, OR WHICH WILL EXCAVATE NATURAL RESOURCES OR A STRUCTURE OR STRUCTURES IN EXCESS OF 60,000 SQUARE FEET GROUND COVERAGE	ISSUES DISCHARGE PERMITS FOR WATER BORNE WASTES LICENSES SOURCES OF AIR EMISSION MAY REQUIRE SOLID WASTE DISPOSAL SITES TO BE LOCATED OR RELOCATED BECAUSE OF WATER QUALITY PROBLEMS. (THIS INCLUDES THE REMOVAL OF ANY WASTE PREVIOUSLY PLACED) TAKE ACTION ON ANY OIL DISCHARGED INTO THE STATE WATERS - NONE ALLOWED CONTROLS DISCHARGE OF MERCURY COMPOUNDS. NONE ALLOWED ABOVE NATURAL CONCENTRATION SITE LOCATION OF DEVELOPMENT LAW WOULD INCLUDE LARGE PERMANENT STORAGE ON DISPOSAL SITES - REVIEWED BY DEP
LAND USE REGULATION COMMISSION		SETS LAND USE PATTERNS IN THE UNORGANIZED AND DEORGANIZED PORTIONS OF THE STATE COMMISSION REVIEW AND APPROVAL REQUIRED FOR ANY DEVELOPMENT DEVELOPING A COMPREHENSIVE LAND USE GUIDANCE PLAN FOR THE UNORGANIZED AND DEORGANIZED PORTIONS OF THE STATE	SITE LOCATION REVIEW AND APPROVAL FOR ALL SUCH STORAGE OR DISPOSAL SITES IN UNORGANIZED OR DEORGANIZED PORTIONS OF THE STATE
STATE PLANNING OFFICE		DEVELOPING COASTAL PLAN FOR THE STATE BASED ON LAND CAPABILITY, WILL IMPLIMENT SHORELAND ZONING IN THOSE COMMUNITIES WHICH DO NOT ZONE THEIR OWN SHORELANDS BY JUNE 1973. (IN CONJUNCTION WITH THE LAND USE REGULATION COMMISSION AND THE DEPARTMENT OF ENVIRONMENTAL PROTECTION)	
MISCELLANEOUS		THERE IS NO TAXATION ON INDUSTRIAL WASTE DISPOSAL SYSTEMS WHICH DO NOT PRODUCE USABLE BY-PRODUCTS. MUNICIPAL LICENSE REQUIRED FOR THE INSTALLATION OF A STATIONARY INTERNAL COMBUSTION OR STEAM ENGINE	NO SOLID WATER DISPOSAL AREA SHALL BE CLOSER THAN 300 FEET TO ANY CLASSIFIED BODY OF WATER. NO OUT-OF-STATE WASTE

- All interstate movement is under jurisdiction of DOT regulations.
- Too few people are qualified to handle accidents involving hazardous materials.
- Certain explosive materials are not acceptable for transport within the State.
- State regulates keeping, disposing or transporting of explosives.
- State requires licensing for all sources of radiation and may establish rules and regulations which could influence the movement of nuclear materials.
- State licenses sources of air emissions.

Law Library Search Findings

Agriculture and Animals

The Department of Agriculture has charge of "economic poisons", the term used for substances or mixtures intended for pest control. To the extent to which this applies to hazardous materials, the Commissioner of Agriculture will register such a substance if it is "...delivered for transportation or transported in intrastate or interstate commerce..." Such transport must provide for the proper labeling of such a substance. (7§581-591)

The Department of Agriculture is also responsible for the enforcement of the Hazardous Substances Labeling Act of 1965 (7§501-513)

Commerce and Trade: Atomic Substances

Several departments and agencies within the State are directed to pursue studies associated with nuclear materials which reflect their own special interests. Included are:

1. Department of Health and Welfare--hazards to public health and safety;
2. Department of Labor and Industry--hazardous working conditions;
3. Industrial Accident Commission--time and character of injuries and resulting compensation;
4. Department of Transportation--transport of materials;

5. Public Utilities Commission--transport of materials and future uses;

6. Department of Public Safety--insurance for hazards; and

7. Department of Forestry, Fisheries, etc.--effect on natural resources of State.

However, only the Department of Health and Welfare has practical duties (10§103-104, rev. 1971)

A Maine Industrial Building Authority also exists which is geared to financing for increased industrial activity in the State. One of its powers is to consult with municipalities as to the "advisability of eligible projects". (10§751 et seq.)

Conservation

At any disposal site, the local Soil Conservation District, if existent, would be concerned with the soil conservation measures of the development (12§1 et seq.)

Other agencies would be involved in the preparation of sites for storage or processing facilities, e.g., the Forest Commissioner would issue a permit for the clearing of an area by burning (12§1551) and would also grant permits for such things as the construction of roads on State lands (12§514).

In terms of the selection of a site for either processing or disposal, the Park and Recreation Commission would control the leasing of any State lands (12§602). Also, depending on the area selected, the new Maine Land Use Regulation Commission could come into play (12§681 et seq.).

Crimes

Under Chapter 91--Nuisances, Section 2701 states that "any person injured in his comfort, property, or the enjoyment of his estate by a common and public or a private nuisance may maintain against the offender a civil action for his damages, unless otherwise specially provided". Grounds for injunctions and other penalties are subsequently stated. The two sections which could be of interest to us deal with certain engines (17§2795) and miscellaneous nuisances (17§2802).

Health and Welfare

Under this title the only direct impact on hazardous waste management would be that the Department of Health and Welfare is authorized and empowered to "make evaluations and determinations of environmental or other health hazards affecting employees in any occupation and to establish appropriate standards related thereto" (22§42-A). Additional responsibility in this area is vested in the Occupational Safety Rules and Regulations Board.

Internal Security and Public Safety

A Department of Public Safety was created in 1971. The Commissioner of this department has the responsibility for "reasonable rules and regulations for the keeping, possession, storage", or transport of all explosives (25§2441).

Motor Vehicles

Section 3 of this title states that "highway use is authorized by any vehicle unless specifically prohibited". No prohibitions presently exist which would significantly influence the transport of hazardous materials. The title itself deals with common regulations, similar in most States. Any specific regulations would have to be addressed to the Secretary of State who oversees rules and regulations for Title 29. 29§903 empowers the Department of Transportation to promulgate rules and regulations for height, width, weight and length of vehicles and also their equipment (29§1652, 1701 et seq.).

Municipalities and Counties

Under Title 30, municipalities can regulate the operation of all vehicles in public ways and even set licensing and rate requirements if not conflicting with Public Utilities Commission. Zoning regulations are standard.

Public Utilities and Carriers

The Public Utilities Commission governs licensing, permits, rates, and extent of liability for all carriers. This commission must be contacted for specific regulations (35§91).

Waters and Navigation

This is the title of most interest to hazardous waste management. The Department of Environmental Protection is the key agency and within it are the Bureaus of Water Quality Control, Air Quality Control, and Land Quality Control.

All waters of the State have been classified according to the standard categories. Regulation of water standards (38§361 et seq.), requirements for waste discharge licensing (38§413), the general enforcement section (38§451), and the specific regulation for the location of solid waste disposal areas (38§421) are applicable.

In the case of air quality, 38§581 et seq. are applicable.

In terms of land quality, the new development site location requirements are quite important (38§481).

Sanitation districts were encouraged by an enabling act signed in 1965 (38§1061 et seq.).

MICHIGAN

Michigan appears inclined toward accepting a national disposal system for hazardous wastes, although its intrastate regulation presently is spotty. Lacking regulation are water quality and explosives processing and storage.

Although there presently are no facilities for radioactive or other hazardous material disposal, new legislation is in process that will control and enforce disposal of radioactive materials. No such wastes are presently buried in the State, but are shipped out of State to an AEC-approved site.

DOT regulations have not been adopted; however, State regulations adequately cover transportation of radioactive materials, pesticides, and explosives. The primary area of regulation regarding hazardous wastes appears to be workers' health and safety, with rules oriented toward satisfying a strong labor influence. Local government has zoning powers over the disposal of wastes that the State agencies do not possess.

An official of the Department of Commerce points out that some 300 major waste producing companies are being contacted by his office in an attempt to establish communication toward developing a practical system for accommodation of the many diverse waste streams produced.

The State presently has detailed guidelines limiting the siting of hazardous wastes; these limitations exceed Federal guidelines but would likely be included in a hazardous waste management system for the State.

Highlights

- Economic poisons must be registered for transport.
- A county may zone any shore land and county land.
- Discharge into State waters of any liquid or solid materials which render the water unsightly, noxious or unwholesome is prohibited.
- The State presently has regulations concerning flammables, explosives, and radioactive materials.
- Radioactive waste are handled according to AEC regulations, generally.
- The following considerations relate to hazardous wastes: 1) leachate testing, 2) finding of wastes for transport and

storage, 3) storage system design, 4) transportation, 5) protection of employees, and 6) final disposal.

- Local units of government have zoning powers which cannot be changed by State agencies.

- Enabling legislation is pending in Michigan which involves radioactive waste disposal. This will provide for 1) control of ionizing radiation emissions, 2) certain contractual agreements with the Federal Government for licensing radioactive materials, 3) designation of the Department of Public Health as the State radiation control agency, 4) establishment of a radiation advisory committee, 5) adoption of rules for implementation of this act, and 6) prescription of penalties for violations.

Law Library Search Findings

The State code of Michigan was consulted for laws relevant to the disposal of hazardous wastes. Key terms were located in the index, alone with the number of the law related to the term. The specific laws were then reviewed for constraints on the disposal of hazardous wastes. Following is a list of the terms used:

1. Wastes
2. Industrial Wastes
3. Pollution of Waters
4. Sanitation
5. Economic Poisons
6. Disposal
7. Natural Resources
8. Interstate Sanitation Commission
9. Environment
10. Environmental Protection Agency
11. Department of Agriculture
12. Ecology
13. Air Pollution
14. Chemicals
15. Zoning
16. Radioactive Materials
17. Department of Highway
18. Water Quality
19. Garbage and Refuse
20. Insecticides
21. Pesticides
22. Sewage
23. Utilities
24. Motor Vehicles
25. Ionizing Radiation

26. Navigable Waters and Shoreline
27. X-Ray Equipment
28. Water
29. Dangerous Substances
30. Hazardous Substances
31. Conservation
32. Health
33. Municipal Pollution Control
34. Planning Commission
35. State Land Use and Development
36. Sanitary Landfills
37. Soil Conservation

This list is by no means comprehensive or exhaustive, although it does represent an initial effort at surveying the legislation. It is perhaps likely that other terms would have revealed more legislative constraints. Although a thorough search was made of the terms listed, this does not imply that other constraints could not have been indexed under different terms in other sections of the State code.

Following is a summary of the legislation thought to be relevant to the disposal of hazardous wastes. The number following the law denotes the specific section of the State code where the particular law may be found. Recent legislation passed in 1971 and 1972 is referred to as a public act (PA) and has not yet been incorporated into the State code.

Air Pollution

The Air Pollution Control Commission may control and abate air pollution. 336.15 Sec. 5-B. The commission may consider for approval plans for air cleaning devices and inspect the installation for compliance with the plans. 336.15 Sec. 5-h. The commission cooperates with U.S. agencies with respect to air pollution control. 336.15 Sec. 5-n.

Land Use

Cities, villages, townships, counties, boards of county road commissions, and the State Highway Commission can purchase and condemn property for the location, development, and construction of a solid waste disposal system. PA 220.

Planning

Plan and specifications for garbage disposal systems must be submitted and approved by the State Commissioner of Health. 123.248 Sec. 8. Provision is made for planning and conducting refuse management systems, to license and regulate refuse disposal facilities and transporting units to regulate collection centers.

Pollution Control

Municipalities are authorized to provide for the financing of water and air pollution control equipment. PA 75.

Shorelands Protection

The Department of Natural Resources shall recommend appropriate use regulations necessary to protect an environmental area. 281.636 Sec. 6.

Transportation

Economic poisons (insecticides, pesticides, etc.) cannot be transported into the State unless they have been registered. 286.163 Sec. 3a-1. All trucks or vehicles used to transport liquid industrial wastes shall have a license. 323.277 Sec. 5. Carriers of hazardous substances engaged in intrastate commerce shall permit the State Director of Agriculture to have access to all records showing movement of hazardous substances in intrastate commerce. 286.461 Sec. 11.

Conservation

It is the duty of the Department of Conservation to guard against the pollution of lakes and streams. 299.3 Sec. 3. The Department of Conservation determines if it is in the public interest to grant a deed or lease to permit use and improvement of the waters. This department also determines the amount of consideration to be paid to the State by the applicant for the lease of unpatented lands. 322.705 Sec. 5.

Construction of Public Utilities

Construction of public utilities upon, over, or under a public road or bridge requires the permission of the Board of County Road Commissioners. 247.184 Sec. 14. Construction of utilities shall not interfere with public uses of roads, bridges, or waters, nor shall trees or shrubs (planted within highway right of way) be destroyed in constructing such utility. 247.185 Sec. 15. Construction of a utility is prohibited on State land in a wilderness area. PA 241.

Fire Prevention

All inflammable or explosive liquids, and other such commodities shall be disposed of so as not to constitute a fire hazard.

Hazardous Substance

It is prohibited to introduce any misbranded hazardous substance into intrastate commerce. 286.454.

Industrial Wastes

A person shall not remove liquid industrial wastes from the premises of another person unless he is licensed. 323.272 Sec. 2. Every industrial or commercial entity which discharges wastes into the water shall have waste treatment or control facilities. PA 129.

Water Resource Commission

The Water Resource Commission is authorized to enforce any and all laws relating to the pollution of the waters of this State. 323.3 Sec. 3. The commission has the right to investigate and inspect conditions relating to the pollution of the waters of the State. 323.4 Sec. 4.

The commission has the authority to expend funds for the extension or improvement of the State or interstate program for the prevention and control of water pollution. 323.201 Sec. 1.

Zoning

A county may zone any shoreland and land which is in the county. 281.637 Sec. 7 (under Shorelands Protection and Management Act)

The above legislation contains not only constraints, but also those laws encouraging the abatement of air and water pollution and makes provision for the construction of facilities for this purpose. The major justification of this legislation is to insure the public health and safety.

Many of the laws are concerned with authorizing various local governments and administrators with the power to enforce anti-pollution laws (including waste disposal legislation). These laws are general in nature; exceptions and particular cases of legislative dispute are not the chief concerns of the State code.

Waste Disposal

Obstructing the navigation of any river or stream by putting into any such river or stream waste materials is prohibited by law. 230.4 Sec. 4. If the water resource commission determines that hazardous or nuisance conditions are resulting from the handling or disposal of liquid industrial wastes it can take action to prevent such conditions. 323. 279 Sec. 9. Any public corporation is authorized to accept aid from the U.S. Government or any agency thereof and from industries for the collection and disposal of wastes from industry. 323.103 Sec. 3-a. No person shall dispose of any refuse at any place except a disposal area licensed as provided in this act. 325.292. A license may be obtained from the State Health Commissioner. 325.293. A person, partnership, corporation, governmental unit or agency desiring a license to operate a disposal area must apply to the State Health Commissioner.

Water Pollution

A person shall not discharge into the waters of the State any liquid or solid materials which render the water unsightly, noxious, or unwholesome. 323.33 Sec. 3-1; 323.6. The council (village) has the authority to provide by ordinance for the preservation of the purity of the waters. 67.38 Sec. 38. Any person who discharges pollutants into State waters may be fined up to $10,000 for each violation and up to $10,000 per day. PA 159. A fund has been established for the control of water pollution (including treatment works used in treatment of industrial wastes) to be used by counties, cities, villages, townships, or other public bodies. PA 215.

NEVADA

The inclination of Nevada's residents and officials toward acceptance of a national hazardous waste disposal site is indeterminable at present but appears doubtful. Local regulation predominates, with State agencies mainly licensing and issuing permits.

Regulation exists in regard to disposal, transportation, processing, and storage of radioactive materials and in regard to air and water quality and land use, but some areas of environmental control are not regulated; there are regulations on pesticides disposal and storage but not on their transportation or processing; on disposal and storage of explosives but not on their transportation or processing; and regulations are totally lacking on solid wastes and industrial safety. There are no existing facilities for disposal of nonradioactive hazardous materials; however, DOT regulations have been adopted.

The key agency in establishing a hazardous waste management system is the State Board of Health, which is charged with preparing a Statewide solid waste disposal plan. Municipalities and counties will be required to develop local plans, which are expected to be more strict than State regulations.

The Commission of Environmental Protection has established air and water quality standards, but even in its own area of jurisdiction it has met with competition from other agencies, e.g., the Lake Tahoe Regional Planning Agency which was established to form a cooperative set of regulations with California in regard to water and land use. Regional planning commissions are required to adopt a master land use plan, or local government can adopt its own plan if not working in conjunction with a regional commission.

Highlights

- Municipalities, cities, counties and districts boards of health are required to develop local solid waste disposal plans. Local disposal regulations can be more strict than State regulations.

- Hazardous wastes are to be stored in water-tight, corrosion resistent, tightly covered and clearly labeled containers in a safe location inaccessible to the public.

- Hazardous wastes cannot be deposited at a disposal site without approval by the health authority.

- Cities and counties are authorized to abate air pollution as a public nuisance.

- A permit is required to discharge radioactive and toxic wastes.

- Counties and cities are given power to regulate and restrict land use, with regional planning agencies power superior to local governments.

- State can regulate licensing of persons to receive, process or transfer radioactive materials.

- Storage of explosives or combustible material within any incorporated area can be prohibited by 10% of the residents.

- A city council may regulate or prohibit the storage of any explosive, combustible, or inflammable material in or transported through the city.

- Nevada requires registration of pesticides but does not have specific regulation relating to transportation or disposal.

- State can regulate surface transportation of hazardous materials.

- Nevada has ambient and emission air quality standards with a permit required for discharge.

- Water discharge permits are required.

Law Library Search Findings

Solid Waste Disposal

Statewide authority for regulation of solid waste disposal is vested in the State Board of Health. It is charged with adopting regulations concerning solid waste management systems, NRS 444.560.

Municipalities (counties and/or cities) and district boards of health (one or more counties) are required to develop local solid waste disposal plans, NRS 444.510. Clark and Washoe, the two most populated counties in the State, have begun their plans. Local disposal regulations can be more strict than State regulations, NRS 444.580.

No statewide solid waste plan has been made.

The Bureau of Environmental Health within the State Board of Health recently issued proposed solid waste regulations. They have not been officially adopted.

AGENCY RESPONSIBILITY

NEVADA	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
PUBLIC SERVICE COMMISSION	ADOPTS AND ADMINISTERS REGULATIONS FOR SURFACE TRANSPORTATION OF HAZARDOUS MATERIALS. DOT REGULATIONS HAVE BEEN ADOPTED.		
STATE BOARD OF HEALTH		LICENSES PERSONS TO RECEIVE, PROCESS, OR TRANSFER RADIOACTIVE MATERIALS.	PREPARING A STATEWIDE SOLID WASTE DISPOSAL PLAN. PROPOSED REGULATIONS FOR DISPOSAL OF HAZARDOUS WASTES REQUIRE SPECIAL CONTAINERS AND PRIOR BOARD APPROVAL.
COMMISSION OF ENVIRONMENTAL PROTECTION		HAS ESTABLISHED AMBIENT AND EMISSION AIR QUALITY STANDARDS. A PERMIT IS NECESSARY FOR AIR EMISSIONS.[2] THE COMMISSION HAS PROPOSED INTRASTATE WATER QUALITY STANDARDS. WATER DISCHARGE PERMITS WILL BE REQUIRED.	
MISCELLANEOUS		COUNTIES MAY REQUIRE STRICTER AIR QUALITY STANDARDS THAN ADOPTED BY THE COMMISSION.[3] CITIES AND COUNTIES ARE AUTHORIZED TO ABATE AIR POLLUTION AS A PUBLIC NUISANCE.[4]	COUNTIES AND CITIES ARE AUTHORIZED TO ZONE.[5] STORAGE OF EXPLOSIVE OR COMBUSTIBLE MATERIALS WITHIN ANY INCORPORATED AREA CAN BE PROHIBITED BY 10 PERCENT OF THE RESIDENTS THEREIN.[6] CITY COUNCILS MAY REGULATE OR PROHIBIT STORAGE AND/OR TRANSPORTATION OF ANY EXPLOSIVE, COMBUSTIBLE, OR INFLAMMABLE MATERIAL.[7] NEVADA JOINED WITH CALIFORNI IN CREATING THE TAHOE REGIONAL PLANNING AGENCY WHICH IS PREPARING A REGIONAL LAND-USE PLAN FOR THE LAKE TAHOE AREA. THE INTERIM PLAN MAY BE ENFORCED BY ORDINANCES. COUNTIES AND CITIES MUST ENFORCE THE PLAN.

[1] THE COMMISSION HAS ADOPTED 49CFR 171-173, 177, 178, 390-397

[2] NRS 445.491

[3] NRS 445.546

[4] NRS 268.410, 244, 361

[5] NRS 278.250

[6] NRS 476.060

[7] NRS 266.310

The proposed regulations (1.4) define hazardous wastes as "those wastes that can cause injury, disease, or property damage, including but not limited to, explosives, pathological wastes, radioactive materials and chemicals". Hazardous wastes are to be "stored in water-tight, corrosion resistent, tightly covered and clearly labeled containers in a safe location, inaccessible to the public. In addition, medical wastes shall be stored in cleanable containers with liners approved by the health authority," 3.3.4. Hazardous wastes cannot be deposited at a disposal site without approval by the health authority, 2.6.1 (a).

Air Pollution Controls

The Commission of Environmental Protection and its administrative arm, the Bureau of Environmental Health, administer the State air pollution laws. It has authority to "establish such emission control requirements as may be necessary to prevent, abate, or control air pollution", NRS 445.461(9). County air pollution programs are also required, NRS 445.546. The counties can apparently require stricter standards than State requirements, NRS 445.-46(2)(a). The Nevada statewide air pollution implementation plan has not been approved by EPA in its entirety.

Specific air quality regulations apply to burning of pathological wastes (6.4) and the storage of volatile compounds (9.1-9.2).

Cities and counties are authorized to abate air pollution as a public nuisance, NRS 268.410, 244.361.

Water Controls

Special legislation exists for protection of Lake Tahoe and its watershed, NRS 445.080-.120.

The Commission of Environmental Protection and its administrative arm, the Bureau of Environmental Health, administer the State water pollution laws. The Commission is given power to adopt water quality and waste discharge standards, NRS 445.215-.220. Interstate standards have been approved by EPA. A permit is required to discharge radioactive and toxic wastes, NRS 445.275.

Land Use Control

Counties and cities are given power to "regulate and restrict the improvement of land and to control the location and soundness of structures", NRS 278.020. Regional planning agencies are also authorized. Their land use powers are superior to those of local government bodies, NRS 278.024, .025. A Lake

Tahoe Regional Planning Agency exists with California, NRS 278.024. A copy of the legislation and further discussion is included with the California land use material. Regional planning commissions are required to adopt a master plan, NRS 278.150. Cities and counties can adopt their own master plan if they do not act in conjunction with a regional planning authority, NRS 278.240. Counties and cities are authroized to zone to carry out the plan, NRS 278.250. Special use permits are available, NRS 278.315.

Radiation Control

NRS 459.040 gives the State Board of Health power to regulate licensing of persons to receive, process, or transfer radioactive materials. Records relating to receipt, storage, transfer, and disposal of radioactive source materials, and also exposure of personnel, are required, NRS 459.060.

Western Interstate Nuclear Compact

This is a body designed to encourage, assist, and guide development of nuclear development in the western States. The coordinating agency, the Western Interstate Nuclear Board, has no regulatory powers, NRS 459.200.

Explosives and Inflammable Materials

Storage of explosive or combustible materials within any incorporated area can be prohibited by 10 percent of the residents, NRS 476.060.

A city council may "regulate or prohibit the storage of any explosive, combustible, or inflammable material in or transported through the city", NRS 266.310.

Pesticides

Nevada requires registration of pesticides but does not have specific regulations relating to transportation or disposal.

Transportation of Hazardous Materials

The Nevada Public Service Commission has adopted parts 171-173, 177, 178, and 390-397 of Title 49 of the Code of Federal Regulations to regulate surface transportation of hazardous materials.

Nuisances

Nevada's nuisance statute is quite broad, NRS 40.140. Any person "whose property is injuriously affected or whose personal enjoyment is lessened by the nuisance" may bring an action for abatement and damages. A nuisance is defined as "anything which is injurious to health, or indecent and offensive to the senses, or an obstruction to the free use of property so as to interfere with the comfortable enjoyment of life or property".

NRS 244.360 provides for a hearing before county commissioners when a nuisance is alleged to exist. If a nuisance is found to exist, the cost of abatement can be assessed against the property.

Public nuisances are defined by statute, NRS 202.450. A hazardous waste processing or disposal site would presumably be "lawfully done" and hence would not fall within the terms of the statute, NRS 202.450.

NEW JERSEY

The State of New Jersey appears favorably inclined toward acceptance of a hazardous waste management system through its primary agency, the Department of Environmental Protection. That agency sets standards of air and water quality, issuing permits for construction of pollution control apparatus and construction and operation of incinerators; it also requires a bill of lading for all shipments of waste chemicals and handles other miscellaneous permits and licenses.

Land use is primarily regulated by municipalities via zoning ordinances. Lacking regulations are transportation, processing and storage of pesticides and also of air and water emissions; industrial safety regulations are under development, as are State land use regulations.

One State official commented that a considerable amount of illegal disposal exists which is very difficult to police and control. Most of the regulations in effect are enforced indirectly by permitting and licensing activities of the DEP rather than directly enforced by officials or their agents.

Highlights

- State requires bill of lading before any industrial wastes can be transported or disposed of.
- Any processing facility would have to meet water and air quality control standards.
- State requires placarding of dangerous materials in conformance with I.C.C. standards.
- State sets standards and issues permits for the construction and operation of incinerators.
- Municipalities can regulate land use.
- State requires registration for all solid waste collectors and handlers.
- State requires permit for liquid storage tanks over 10,000 gallons.
- State requires registration of all sources of radiation.

AGENCY RESPONSIBILITY

NEW JERSEY	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL	MISCELLANEOUS
DIVISION OF MOTOR VEHICLES	MAY REVOKE OR SUSPEND THE LICENSE OR REGISTRATION FOR VIOLATION OF HAZARDOUS SHIPMENT REQUIREMENTS REGULATIONS			
PUBLIC UTILITIES COMMISSION	REGULATES COMMON CARRIERS AND REQUIRES PLACARDING OF DANGEROUS MATERIALS			
DEPARTMENT OF ENVIRONMENTAL PROTECTION	REQUIRES BILL OF LADING ON EVERY SHIPMENT OF WASTE CHEMICALS	SETS STANDARDS FOR WATER QUALITY SETS STANDARDS FOR AIR QUALITY ISSUES PERMITS FOR INDUSTRIAL CONSTRUCTION OF AIR AND WATER POLLUTION CONTROL APPARATUS SETS STANDARDS AND ISSUES PERMITS FOR THE CONSTRUCTION AND OPERATION OF INCINERATORS	REQUIRES PERMIT FOR OCEAN DUMPING REQUIRES REGISTRATION FOR ALL SOLID WASTE COLLECTORS AND HANDLERS REQUIRES PERMIT FOR UNDERGROUND STORAGE DEVELOPS REGULATIONS FOR LANDFILLS REQUIRES LABELING OF ALL HAZARDOUS WASTES TO INSURE SAFE DISPOSAL REQUIRES PERMIT FOR LIQUID STORAGE TANKS OVER 10,000 GALLONS MAY ISSUE OPEN BURNING PERMITS FOR DISPOSAL OF HAZARDOUS MATERIALS WHEN THERE IS NO OTHER FEASIBLE DISPOSAL METHOD	CONTROLS MOVEMENT AND HANDLING OF PESTICIDES REGUALTES USES OF COASTAL WETLANDS SETS RULES AND REGULATIONS FOR RADIATION CONTROL REGISTERS ALL SOURCES OF RADIATION
MISCELLANEOUS	SHIPMENT OF ALL HAZARDOUS MATERIALS REQUIRES PLACARDING. CONFORMANCE TO ICC RULES IS CONSIDERED COMPLIANCE TURNPIKE AND EXPRESSWAY LAWS ON HAZARDOUS SUBSTANCES ARE GENERAL - "SO AS NOT TO ENDANGER UNREASONABLY..."	MUNICIPALITIES HAVE ZONING RIGHTS	APPARENTLY THERE IS A CONSIDERABLE AMOUNT OF ILLEGAL DISPOSAL IN THIS STATE - VERY DIFFICULT TO POLICE AND CONTROL	

NEW YORK

Any State which will be considering steps to take in order to best assimilate a national hazardous waste disposal system into its existing legislative structure would be wise to follow the lead of the State of New York. With an eye to later adopting a national hazardous waste disposal system, New York in the fall of 1972 consolidated all its existing regulations pertaining to environmental protection, vesting them in the newly created Department of Environmental Conservation. This department emphasizes consideration of the impact of disposal of all types of wastes on water quality and directs all activities to conform to its standards; these are expected to become even more stringent.

Areas in which regulation is lacking include the transportation, processing, and storage of pesticides, water and air emissions, and statewide land use zoning which is under development. There are existing facilities for both radioactive and other hazardous waste materials; New York presently is burying low-level radioactive and other hazardous waste materials but storing high-level wastes.

Specific exceptions to the location of sites for hazardous waste disposal are the mountain resort areas of the Adirondacks and the Catskills.

Highlights

- State sets standards and is responsible for issuing permits and monitoring discharges for air and water quality.
- State Regulates control and labeling of pesticides.
- City, village, thruway authority, county park commission, bridge authority, Department of Parks and Recreation, and Department of Environmental Conservation may regulate transportation of hazardous material under its jurisdiction.
- State requires bill of lading for shipment of all hazardous materials.
- Unconsolidated laws state that no person shall transport any hazardous substance which is likely to endanger any person or property.
- New York is presently burying low-level radioactive wastes and storing high-level wastes.
- The forest preserves in the Adirondacks and in the Catskills will not be acceptable for hazardous waste disposal.

AGENCY RESPONSIBILITY

NEW YORK	TRANSPORTATION	PROCESSING	DISPOSAL/STORAGE	MISCELLANEOUS COMMENTS
DEPARTMENT OF ENVIRONMENTAL OBSERVATION	ISSUES PERMITS FOR PIPELINE CONSTRUCTION REQUIRES REGISTRATION OF PESTICIDES FOR SHIPPING REQUIRES BILL OF LADING FOR ALL HAZARDOUS MATERIALS IN SHIPMENT DEVELOPING PERMIT AND PLACARDING SYSTEM FOR VEHICLES HAULING MATERIALS HAZARDOUS TO THE ENVIRONMENT REQUIRES REGISTRATION OF ALL VEHICLES USED BY WASTE SCAVENGERS.	ESTABLISHES, ENFORCES WATER QUALITY STNDS. ESTABLISHES, ENFORCES AIR QUALITY STNDS. ISSUES AND MONITORS DISCHARGE PERMITS FOR MAINTAINING WATER QUALITY ASSISTS LOCALITIES IN DEVELOPING PLANS FOR LAND USE	ISSUES PERMITS AND MONITORS DISCHARGES INTO THE AIR AND WATER AND INTO ANY LAND AREA WHICH MAY AFFECT THE GROUND OR SURFACE WATERS REGULATE STORAGE AND DISCHARGE OF MATERIAL "HAZARDOUS TO THE ENVIRONMENT" (LISTING OF SUBSTANCES NOT COMPLETE AT THIS TIME) PROVIDE GRANTS FOR STUDY AND PLANNING TO ASSIST LOCAL COMMUNITIES IN DESIGN AND LOCATION OF SOLID WASTE DISPOSAL REGULATE ACTIVITIES OF WASTE SCAVENGERS - ALL DISPOSAL MUST BE IN SITES APPROVED BY THE DEPT. ISSUE PERMITS AND REGULATES LEASING OF UNDERGROUND STORAGE SITES (GAS STORAGE)	OUTSIDE OF THE SAFETY ASPECTS OF TRANSPORTATION AND MANUFACTURE THE DEPT. OF ENVIRONMENTAL CONS. IS RESPONSIBLE FOR ALL THE ESSENTIAL ELEMENTS OF ANY HAZARDOUS WASTE DISPOSAL SYSTEM DEC APPEARS FAVORABLY INCLINED TOWARD A NATIONAL SYSTEM FOR THOSE MATERIALS WHICH DON'T LEND THEMSELVES TO EASY HANDLING OR RECOVERY.
DEPARTMENT OF TRANSPORTATION	PLANS AND ADMINISTERS PUBLIC SAFETY PROGRAM FOR RAIL AND MOTOR CARRIERS IN INTRASTATE COMMERCE			
DEPARTMENT OF MOTOR VEHICLES	REQUIRES CONSPICUOUS PLACARDING OF ALL HIGHWAY VEHICLES CARRYING DANGEROUS MATERIALS REGULATIONS FOR THE CONSTRUCTION AND EQUIPPING OF SUCH VEHIC.			
DEPARTMENT OF LABOR	REQUIRES A LICENSE FOR TRANSPORTING EXPLOSIVES NOT MOVING UNDER FEDERAL REGULATIONS	RESPONSIBLE FOR THE HEALTH AND SAFETY OF ALL EMPLOYEES IN FACTORIES . . . . IN HANDLING, STORAGE AND MANUFACTURE OF EXPLOSIVES		
DEPARTMENT OF PUBLIC SERVICES		SUPERVISES OPERATION OF UTILITIES FOR SAFETY		
MISCELLANEOUS/ COMMENTS	NAVIGATION LAWS PROHIBIT CARRYING EXPLOSIVES AND BURNING FLUIDS OR ANY DANGEROUS ARTICLES ON SHIPS CARRYING PASSENGERS. GENERAL BUSINESS LAWS PROHIBIT THE TRANSPORT OF DANGEROUS ARTICLES IN AIRCRAFT EXCEPT AS IN CONFORMANCE WITH FEDERAL REGULATIONS VEHICLE AND TRAFFIC LAWS "THE TRANSPORTATION OF COMBUSTIBLES, CHEMICALS, EXPLOSIVES . . . OR OTHER DANGEROUS MATERIALS MAY BE REGULATED BY ANY CITY, VILLAGE, THRUWAY AUTHORITY, BRIDGE AUTHORITY . . . ON ANY HIGHWAY IN ITS JURISDICTION UNCONSOLIDATED LAWS - PROVIDES THAT NO PERSON SHALL TRANSPORT ANY OF NUMEROUS HAZARDOUS SUBSTANCES AT SUCH TIMES OR IN SUCH A MANNER OR CONDITION AS TO ENDANGER UNREASONABLE OR TO BE LIKELY TO . . . PERSONS OR PROPERTY.	NUCLEAR FUEL SERVICES, INC. HAS A NUCLEAR RE PROCESSING PLANT AT THE N.Y. ATOMIC AND SPACE DEVELOPMENT AUTHORITY - WESTERN N.Y. NUCLEAR SERVICE CENTER, WEST VALLEY (3300 ACRE NUCLEAR INDUSTRIAL RESERVATION) ENVIRONMENTAL SYSTEMS IS A COMPANY IN SYRACUSE THAT IS GOING TO HANDLE PETROLEUM WASTES (IT MOVED IN FROM BOSTON) CHEM-TROL POLLUTION SERVICES, INC. IS PROCESSING A LARGE VARIETY OF INDUSTRIAL WASTES AND HAVE BEEN USED TO DISPOSE OF SELECTED WASTE PESTICIDES. THEY ARE IMPORTING WASTES (ETCHING WASTES) FROM AS FAR AWAY AS THE STATE OF WASH. PRS SYSTEMS, INC. HAS DESIGNED A PORTABLE HIGH TEMPERATURE INCINERATOR FOR DISPOSAL OF TOXIC WASTES. N.Y. STATE AND PRS HAVE A JOINT PROPOSAL INTO EPA FOR A PILOT OPERATION TO APPLY THE TECHNOLOGY IN GENERAL, THE DISPOSAL OF INDUSTRIAL WASTES IN N.Y. IS BEING FOCUSSED UPON PRIVATE, ECONOMIC ACTIVITY IN RECYCLING, PROCESSING AND DISPOSAL	NY HAS A SITE IN USE FOR BURYING LOW LEVEL RADIOACTIVE WASTE AND IS STORING HIGH LEVEL WASTE THERE IS A LARGE AMOUNT BANNED OR DEFECTIVE PESTICIDES BEING HELD BY INDIVIDUALS IN ANTICIPATION OF THE DEVELOPMENT OF STATE DISPOSAL FACILITIES WASTES AFFECTING FISH OR FINFISH SHALL NOT BE ALLOWED INTO THE WATERS OF THE MARINE DISTRICT. THE FOREST PRESERVES IN THE ADIRONDACKS AND IN THE CATSKILLS WILL NOT BE ACCEPTABLE AREAS FOR ESTABLISHING ANY DISPOSAL ACTIVITY.	NEW YORK HAS ONE OF THE MOST ADVANCED PESTICIDE CONTROL LAWS IN THE COUNTRY (COPY ENCLOSED)

Law Library Search Findings

Environmental Conservation Law

The Environmental Conservation Law took effect September 1, 1972. This law consolidates various regulations scattered throughout the State statutes and transfers them to the Department of Environmental Conservation (DEC). The Department sets water standards and is responsible for the issuing and monitoring of discharge permits. Discharges are prohibited and requirements for permits for new discharges are discussed in §17-0501, 0503, 0505, 0507, 0509, 0511, and 0701. The Department also has responsibility for sales and regulations applying to the storage of liquids likely to pollute waters, including regulations on construction, maintenance, diking, etc. §17-0303.

The Department of Environmental Conservation also establishes rules and regulations for controlling, preventing, and prohibiting air pollution (standards included), and regulates the leasing of underground storage areas for gas. §23-1301, 1303, 1305, 1307. Article 27 of the Environmental Conservation Law deals, in part, with solid industrial wastes and industrial waste scavangers. The DEC has several regulations concerning the control and labeling of pesticides. Recently added responsibilities of DEC are in regard to hazardous substances. §320.

Navigation Law

Passenger-carrying ships are prohibited from carrying "explosive burning fluids or dangerous articles". §66.

General Business Law

Transportation of explosives and other dangerous articles prohibited in aircraft except when in conformance with Federal regulations. §245.

Vehicle and Traffic Law

Definition of dangerous articles, including hazardous substances. Amendment also recorded and attached. §380. Requires that vehicles carrying explosive substances of flammable liquids stop at railroad crossings. 29§1171.

The "transportation of combustibles, chemicals, explosives, inflammables, or other dangerous substances, articles, compounds or mixtures" may be regulated by any city, village (Article 39-§1642), thruway authority, county park commission, bridge authority, the Department of Parks and Recreation, or the Department of Environmental Conservation on any highway under its jurisdiction (Article 38-§1630).

Unconsolidated Law

Provides that no person shall transport any of numerous hazardous substances "at such time or place or in such a manner or condition as to endanger unreasonably or so as to be likely to endanger unreasonably persons or property". Title 17-§6808.

Labor Law

The Department of Labor requires a license for transporting explosives not already being moved under Federal regulation.

OREGON

The inclination of the residents and officials of Oregon to embrace a national hazardous waste disposal system is difficult to determine at present, due to the strong influence of local environmental control. For example, the Board of County Commissioners in any county is authorized to regulate disposal of solid wastes; cities and counties are authorized to regulate land use by zoning and to create planning commissions; and regional air pollution control authorities may set standards for air quality. However, all hazardous disposal sites must be deeded to the State, and most licensing and permitting responsibilities are placed in the jurisdiction of the State.

The key hazardous waste management implementation agency for Oregon is the Department of Environmental Quality, which has set discharge and ambient air and water quality standards and has specified regulations for processing and disposal of hazardous materials. It stipulates that wastes generated outside Oregon cannot be processed within the State without its specific approval.

Lacking regulations presently are the processing of pesticides; the transportation, processing, and storage of radioactive materials; the processing of explosives; and the handling of hazardous materials from an industrial safety aspect. There are no existing facilities for disposal of radioactive or other hazardous wastes. However, the Oregon Nuclear and Thermal Energy Council has been authorized to "regulate the transportation process for all radioactive material derived from or destined for nuclear installations", but has not as yet adopted any regulations. This authority appears to be in conflict with that granted to the Public Utility Commission which has adopted DOT regulations in this area.

Although there is no specific shoreline land use regulation, the State Highway Commission's approval must be obtained before instituting improvements on ocean shorelines or on land within one-quarter of a mile of scenic waterways.

Oregon is the only State surveyed in the West which has legislation dealing specifically with hazardous waste disposal. Another unique feature of Oregon's legislative structure is that the Governor is authorized to regulate land use that is not otherwise regulated by a State or local agency.

Highlights

- Disposal of hazardous wastes requires DEQ or health department permission.
- Hazardous waste containers must be adequately identified.
- Board of County Commissioners in any county is authorized to regulate and abate solid wastes.
- A license from DEQ is required to operate a disposal site for hazardous materials.
- All hazardous disposal sites must be deeded to State.
- State authorized to require permits for sources of air contaminants.
- Regional Air Pollution Control Authorities are authorized to set standards for water quality and purity.
- A permit is required to discharge any waste into waters of the State.
- Discharge and ambient air and water quality standards have been adopted. Permits are required to discharge.
- Cities and counties are authorized to regulate land use.
- Governor is authorized to regulate land use which is not regulated by other agencies.
- Oregon has recently adopted innovative legislation on hazardous wastes disposal.
- Oregon's Nuclear and Thermal Energy Council has authority to assess environmental issues in this area.

Law Library Search Findings

Solid Waste Disposal

Statewide solid waste disposal activities are administered by the Environmental Quality Commission and the Department of Environmental Quality (DEQ). ORS 459.025. The Commission is authorized to adopt "regulations governing the accumulation, storage, collection, transportation and disposal of solid wastes..." ORS 459.045(a).

Hazardous wastes are defined in the regulations as being dangerous materials not including environmentally hazardous wastes

AGENCY RESPONSIBILITY

OREGON	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
PUBLIC UTILITIES COMMISSION	DOT REGULATIONS FOR TRANSPORTATION OF HAZARDOUS MATERIALS ARE IN THE PROCESS OF BEING ADOPTED[1]		
DEPARTMENT OF ENVIRONMENTAL QUALITY		DISCHARGE AND AMBIENT AIR AND WATER QUALITY STANDARDS HAVE BEEN ADOPTED. PERMITS ARE REQUIRED FOR DISCHARGE INTO WATER. AIR EMISSION STANDARDS HAVE BEEN ESTABLISHED FOR A VARIETY OF POLLUTANTS. UNLESS A VARIANCE IS GRANTED, THE HIGHEST AND BEST POSSIBLE POLLUTION CONTROL IS REQUIRED. DISCHARGE OF TOXIC WASTES INTO PUBLIC WATERS IS PROHIBITED.	THE DEPARTMENT HAS ADOPTED SPECIFIC REGULATIONS FOR THE PROCESSING AND DISPOSAL OF HAZARDOUS MATERIALS. ALL HAZARDOUS MATERIAL MUST BE DECONTAMINATED OR DISPOSED OF ON STATE-OWNED LAND BY AN OPERATOR LICENSED BY THE STATE. WASTES GENERATED OUTSIDE OREGON CANNOT BE PROCESSED WITHOUT SPECIFIC APPROVAL FROM THE DEPARTMENT.[2]
STATE FIRE MARSHALL	HAS ADOPTED REGULATIONS FOR THE STORAGE AND TRANSPORTATION OF EXPLOSIVES AND FLAMMABLE MATERIALS		
NUCLEAR AND THERMAL ENERGY COUNCIL	AUTHORIZED TO REGULATE TRANSPORTATION OF RADIOACTIVE MATERIAL TO AND FROM ANY NUCLEAR INSTALLATION		
MISCELLANEOUS			COUNTIES AND CITIES ARE AUTHORIZED TO ZONE. THE GOVERNOR IS AUTHORIZED TO REGULATE LAND USE IN AREAS NOT REGULATED BY CITIES OR COUNTIES.[3] IMPROVEMENTS ON OCEAN SHORELINES OR WITHIN ONE-QUARTER MILE OF SCENIC WATERWAYS MUST BE APPROVED BY THE STATE HIGHWAY COMMISSION.[4]

[1] 49CFR 177, 390-393, 395-397

[2] ORS 459.410 - 459.690

[3] ORS 215.505

[4] ORS 390.640, 390.845

as defined in ORS 459.410(6), 61-010(7). Disposal of hazardous wastes requires DEQ or health department permission. 61-060(2). Hazardous waste containers must be adequately identified. 61-07-(5), (6).

The board of county commissioners in any county is authorized to regulate and abate solid waste on private property in unincorporated areas as a public nuisance. ORS 495.120, 459.150.

Permits for waste disposal sites must be obtained from the Department of Environmental Quality. ORS 459.205.

Hazardous Wastes

Oregon is the only western State which has legislation dealing specifically with hazardous waste disposal. ORS 62 (copy attached).

Defined environmentally hazardous wastes include pesticides, radioactive material, toxic materials, and containers for any of these materials. ORS 459.410(6), 62-010(6).

The Department of Environmental Quality is given broad powers to regulate disposal of hazardous wastes. ORS 459.430, .440.

A license from DEQ is required to operate a disposal site for environmentally hazardous wastes. ORS 459.510. Detailed application forms must be completed and public hearings held. 62-025, 62-035. The license is issued after approval by the Environmental Quality Commission. "As a condition of issuance of the license, the licensee must deed the disposal site to the State, title to be taken in the name of the State of Oregon." ORS 459.590(1).

Air Pollution

The Department of Environmental Quality administers air pollution control law on a statewide basis. It is authorized to require permits for sources of air contaminants, ORS 449.727(1), and monitoring of air discharges, ORS 449.702. It is also authorized to establish air purity standards in appropriate portions of the State, ORS 449.785. Regional air quality control authorities are authorized by ORS 449.855. Regional standards cannot be less strict than standards adopted by the DEQ. ORS 449.855(2).

Prior to the recent non-degradation court case, Oregon's clean air implementation plan had been fully approved by EPA.

Strict air pollution standards apply to areas designated as wilderness areas by the U.S. Congress. 13-020.

Water Pollution

The Environmental Quality Commission is authorized to establish standards of quality and purity for all waters in the State. ORS 449.081(3). A permit from the Department of Environmental Quality is required to discharge any waste into the waters of the State. ORS 449.083(1)(a). Permits may be denied, suspended, modified, or revoked by DEQ. ORS 449.083(2).

A DEQ regulation, 41-010, requires the "highest and best practicable treatment and/or control" of waste discharges.

Industrial waste facilities are required to be operated at "their highest practical efficiency at all times," 42-005, and to keep records to prove effective operations. 42-010." Industrial waste means any liquid, gaseous, radioactive, or solid substance or a combination thereof resulting from any industrial process. 41-005(2). Permits are required to dispose of industrial wastes in waste disposal wells. 44-015.

Toxic wastes are wastes which "can reasonably be expected to cause a hazard to fish or other aquatic life." 45-010(10). Discharge of toxic wastes into public waters is prohibited. 45-020(1)(c).

Oregon's interstate water quality regulations have been fully approved by EPA.

Land Use

A summary of planning and zoning law is on pages 50-52 of the Study Design prepared for the Oregon Coastal Conservation and Development Commission.

Counties are authorized to create planning commissions. ORS 215.020. The planning commission must adopt a comprehensive plan, ORS 215.050, and may recommend to the legislative body zoning or other means appropriate to carrying out the plan. ORS 215.110.

Cities are also suthorized to create planning commissions. ORS 227.020. Their duties are only advisory in nature. ORS 227.020. The city councils are authorized to zone. ORS 227.220.

The Governor is authorized to prescribe and administer land use plans for areas not regulated by cities or counties. ORS 215.505.

Ownership of ocean beaches in Oregon up to the ordinary high tide line is vested in the State. ORS 390.615. Improvements on the ocean shoreline up to the line of vegetation must be approved by the State Highway Engineer. ORS 390.640.

Oregon has designated certain river segments as scenic waterways. ORS 390.825. Improvements within one-fourth mile of scenic waterways must be approved by the State Highway Commission. ORS 390.845.

The Oregon Coastal Conservation and Development Commission was created in 1971. ORS 191.120. Its primary mission is to prepare a comprehensive plan "for the preservation and development of the natural resources of the coastal zone". ORS 191. 140(2). Further information is in the Study Design prepared for the Commission.

Nuisances

Persons adversely affected by private nuisances are given a statutory right to bring an action for damages and abatement. ORS 105.505.

Pollution of State waters, discharges into waters thereby reducing quality below applicable standards, and violation of a waste discharge permit are designated as public nuisances. ORS 459.079.

Explosives

The Oregon State Fire Marshall has adopted regulations applicable to the storage and transportation of explosives and flammable materials. ORS 480.050, .060 prohibits transportation of certain explosives by common carriers engaged in carrying passengers.

Radiation

The Oregon Nuclear and Thermal Energy Council is authorized to "regulate the transportation process for all radioactive material derived from or destined for any nuclear installation". ORS 453.535. Regulations have not yet been adopted. The authority granted the Council appears to conflict with authority granted the Public Utility Commission, according to the Council's coordinator.

Pesticides

The Department of Agriculture "is authorized to take all measures or to make any seizure or embargo necessary and proper to protect property, or the health or life of animals or humans, from the incorrect sale, storage, handling, transporting, disposal, (other than as provided in the solid waste legislation, ORS 459) or use of pesticides, residues from the manufacture of pesticides or other dangerous chemicals". ORS 634.350.

Transportation of Hazardous Materials

Oregon is in the process of adopting 49 CFR 177, 390-393, and 395-397 relating to transportation of Hazardous material.

Industrial Regulations

Minimal regulations exist for protecting workers from hazardous materials with which they may come in contact. CH. 333, 22-038, -040.

Oregon Legislation Specifically Dealing with Hazardous Waste Disposal

CH 340, 62-005,-045.

> *"62-010 PURPOSE. The purpose of these regulations is to prescribe uniform procedures for obtaining licenses from the Department of Environmental Quality for establishing and operating environmentally hazardous waste disposal sites and facilities as prescribed by ORS 495.410-459.690."*
>
> *"62-010 DEFINITIONS. As used in these regulations unless otherwise required by context:*
>
> *(1) "Commission" means the Environmental Quality Commission.*
> *(2) "Department" means the Department of Environmental Quality.*
> *(3) "Director" means the Director of the Department of Environmental Quality.*
> *(4) "Dispose" or "Disposal" means the discarding, treatment, recycling or decontamination of environmentally hazardous wastes or their collection, maintenance or storage at a disposal site.*
> *(5) "Disposal Site" means a geographical site in or upon which environmentally hazardous wastes are stored or otherwise disposed of in accordance with the provisions of ORS 459.410-459.690.*
> *(6) "Environmentally Hazardous Wastes" means Environmentally Hazardous Wastes as defined by ORS 459.410, which includes discarded, useless or unwanted pesticides or pesticide residues, low-level radioactive wastes and receptacles and containers used therefor, that, because of their high concentration and/or persistence of toxic elements or other hazardous proper-*

ties, and which have not been detoxified or cannot be detoxified by any practical means, may be classified by the Environmental Quality Commission as Environmentally Hazardous Wastes pursuant to ORS 459.410, but shall not include Environmentally Hazardous Wastes which have been detoxified by treatment, reduction in concentration of the toxic element or by any other means and formally declassified by the Environmental Quality Commission as no longer hazardous to the environment.

(7) "License" means a written license issued by the Commission, bearing the signature of the Director, which by and pursuant to its conditions authorizes the licensee to construct, install, modify or operate specified facilities or conduct specified activities for disposal of environmentally hazardous wastes.

(8) "Person" means the United States and agencies thereof, any state, any individual, public or private corporation, political subdivision, governmental agency, municipality, industry, copartnership, association, firm, trust, estate or any other legal entity whatsoever."

"62-015 LICENSE REQUIRED.

(1) No person shall dispose of environmentally hazardous wastes upon any land in the state other than real property owned by the State of Oregon and designated as a disposal site pursuant to the provisions or ORS 459.410-459.690 and these regulations.

(2) No person shall establish or operate a disposal site without a license therefor issued by the Commission pursuant to ORS 459.410-459.690 and these regulations.

(3) Licenses issued by the Department shall establish minimum requirements for the disposal of environmentally hazardous wastes, limits as to types and quantities or materials to be disposed, minimum requirements for operation, maintenance, monitoring and reporting and supervision of disposal sites, and shall be properly conditioned to ensure compliance with pertinent local, state and federal standards and other requirements and to adequately protect life, property and the environment.

(4) Licenses shall be issued to the applicant for the activities, operations, emissions or discharges of record, and shall be terminated automatically upon issuance of a new or modified license for the same operation."

"62-020 NECESSITY FOR A DISPOSAL SITE. Any person proposing to establish or obtain a license for a disposal site for Environmentally Hazardous Wastes shall prepare and submit to the Department a detailed report with supporting information, justifying the necessity for a disposal site as proposed, including anticipated sources of wastes and types and quantities of wastes to be disposed. Environmentally Hazardous Wastes generated outside the State of Oregon and proposed to be imported for disposal in Oregon shall receive specific approval by the Environmental Quality Commission prior to said disposal."

"62-025 APPLICATION FOR LICENSE.

(1) Any person wishing to obtain a new modified or renewal license from the Department shall submit a minimum of eight (8) copies of a written application on forms provided by the Department. All application forms must be completed in full, signed by the applicant or his authorized representative and shall be accompanied by a minimum of eight (8) copies of all required exhibits.

(2) An application for a license shall contain but not be limited to:

(a) The name and address of the applicant and person or persons to be directly responsible for the operation of the disposal site.

(b) A statement of financial condition of the applicant, prepared by a certified public accountant and including assets, liabilities and net worth.

(c) The experience of the applicant in construction, management supervision or development of disposal sites for environmentally hazardous wastes and in the handling of such substances.

(d) The management program for the operation of the disposal site, including the person or persons to be responsible for the operation of the disposal site and a resume of his qualifications, the proposed method of disposal, the proposed method of pretreatment or decontamination upon the disposal site, if any, and the proposed emergency measures and safeguards to be provided for the protection of the natural resources, the public and the employees at the disposal site.

(e) A schedule and description of sources, types and quantities of material to be disposed and detailed procedures for handling and disposal of each.

(f) A description of the size and type of facilities to be constructed upon the disposal site, including the height and type of fencing to be used, the size and construction of structures or buildings, warning

signs, notices and alarms to be used, the type of drainage and waste treatment facilities and maximum capacity of such facilities, the location and source of each water supply to be used and the location and the type of fire control facilities to be provided at such site.

(g) A preliminary engineering sketch and flow chart showing porposed plans and specifications for the construction and development of the site and the waste treatment and water supply facilities, if any, to be used at such site.

(h) The exact location and place where the applicant proposes to operate and maintain the disposal site, including the legal description of the lands included within such site.

(i) A preliminary geologist's survey report indicating land formation, location of water resources and directions of the flows thereof and his opinion relating to possible sources of contamination of such water resources.

(j) A proposed program for continuous monitoring and surveillance of the disposal site and for regular reporting to the Department.

(3) License applications must contain or be accompanied by the following:

(a) A nonrefundable fee of $5,000 which shall be continuously appropriated to the Department for administrative expenses.

(b) A proposal and supporting information justifying the amounts of liability insurance proposed to protect the environment and the health, safety and welfare of the people of this state, including the names and addresses of the applicant's current or proposed insurance carriers and copies of insurance policies then in effect.

(c) A proposal and supporting information justifying the amount of a cash bond proposed to be posted by the licensee and deemed to be sufficient to cover any costs of closing the site and monitoring it or providing for its security after closure and to secure performance of license requirements.

(d) A proposal and supporting information justifying the proposed fees to be paid to the Department based either on the quantity and type of material accepted at the disposal site or a percentage of the fee collected for disposal or both, in amounts estimated to produce over the period of use of the site for disposal a sum sufficient to provide for any monitoring or protection of the site after closure.

(4) The Department may require the submission of such other information as it deems necessary to make a decision on

granting, modifying or denying a license.

(5) Applications which are incomplete, unsigned or which do not contain the required exhibits, clearly identified, may be excluded from consideration by the Department at is [sic] discretion and the applicant shall be notified in writing of the deficiencies."

"62-030 ENGINEERING PLANS REQUIRED. Before a disposal site or operation may be established, constructed, maintained or substantially modified, an applicant or licensee must submit to the Department final detailed engineering plans and specifications, prepared by a registered professional engineer, covering construction and operation of the disposal site and all related facilities and receive written approval of such final plans from the Department."

"62-035 HEARINGS AND ISSUANCE OR DENIAL OF A LICENSE.

(1) Upon receipt of an application, the Department shall cause copies of the application to be sent to affected state agencies, including the State Health Division, the Public Utility Commissioner, the Fish Commission of the State of Oregon, the State Game Commission and the State Engineer and to such other agencies or persons that the Department deems appropriate. ORS 459.410-459.690 provides that each agency shall respond by making a recommendation as to whether the license application should be granted. If the State Health Division recommends against granting the license, the Commission must deny the license.

(2) After determination that an application for a license is complete, the Department will notify the applicant of its intent to schedule a hearing or hearings and the timetable and procedures to be followed. The Commission shall conduct hearings at such other places as the Department considers suitable. At the hearing the applicant may present his application and the public may appear or be represented in support of or in opposition of the application.

(3) Prior to holding hearings on the license application, the Commission shall cause notice to be given in the county or counties where the proposed disposal site is located, in a manner reasonably calculated to notify interested and affected persons of the license application.

(4) The Department shall make such investigation as it considers necessary and following public hearings make a recommendation to the Commission as to whether or not a license should be issued. The recommendations of the Department, including proposed license provi-

sions and conditions if the Department recommends issuance of a license, shall be forwarded to the applicant, to members of the Commission and, at the discretion of the Department, to other interested persons for comment. All comments must be submitted in writing within fourteen (14) days after mailing of the Department's recommendations if such comments are to receive consideration prior to final action on the application.

(5) After fourteen (14) days have elapsed since the date of mailing of the Department's recommendations and after reviewing the Department's recommendations the Commission shall decide whether to issue the license or not. It shall cause notice of its decision to be given to the applicant by certified mail at the address designated by him in his application.

(6) If the Commission refuses to issue a license, it shall afford the license applicant an opportunity for hearing after reasonable notice, served personally or by registered or certified mail. The notice shall contain:

(a) A statement of the party's right to hearing or a statement of the time and place of the hearing.

(b) A statement of the authority and jurisdiction under which the hearing is to be held.

(c) A reference to the particular sections of the statutes and rules involved.

(c) A short and plain statement of the matters asserted or charged."

"62-040 RENEWAL, MODIFICATION, TERMIANTION OR EXPIRATION OF LICENSE.

(1) An application for renewal, modification or termination of a license or to allow a license to expire shall be filed in a timely manner, but not less than ninety (90) days prior to the expiration date of the license. Procedures for issuance of a license shall apply to renewal, modification, termination or expiration of a license except that public hearings will not be held unless desired by the Commission. A license shall remain in effect until final action has been taken by the Commission on any appropriately submitted and complete application pending before the Commission.

(2) In the event that the Commission finds it necessary to modify a license due to changed conditions or standards, receipt of additional information or any reason it deems would threaten public health and safety, the Department shall notify the licensee or his authorized representative by certified mail

of the Commission's intent to modify the license. Such notification shall include the proposed modification and the reasons for modification. The modification shall become effective twenty (20) days from the date of mailing of such notice unless within that time the licensee requests a hearing before the Commission. Such a request for hearing shall be made in writing and shall include the reasons for such hearing. At the conclusion of any such hearing the Commission may affirm, modify or reverse the proposed modification."

"62-045 SUSPENSION OR REVOCATION OF A LICENSE.

(1) Whenever, in the judgment of the Department from the results of monitoring or surveillance of operation of any disposal site, there is reasonable cause to believe that a clear and immediate danger to the public health and safety exists from the continued operation of the site, without hearing or prior notice, the Department shall order the operation of the site halted by service of the order on the site superintendent.

(2) Within twenty-four (24) hours after such order is served, the Department will appear in the appropriate circuit court to petition for such equitable relief as is required to protect the public health and safety and may commence proceedings for the revocation of the license of the disposal site if grounds therefore exist.

(3) In the event that it becomes necessary for the Commission to suspend or revoke a license due to violation of any providiosn of ORS 459.410-459.690, non-compliance with these rules or the terms of the license, the threat of degradation of a natural resource, unapproved changes in operation, false information submitted in the application or any other cause the Department shall schedule a public hearing and notify the licensee by certified mail of the Commission's intent to suspend or revoke the license and the timetable and procedures to be followed. Any hearing held shall be conducted pursuant to the regulations of the Department."

SOUTH CAROLINA

The State of South Carolina appears favorably inclined toward establishment of a hazardous waste management system, although much of its environmental legislation is incomplete at present. Areas in which legislation is lacking include the transportation and processing of radioactive materials; disposal, processing, and storage of explosives; and discharge permitting of air emissions. Still lacking regulation but under development are the disposal, transportation, processing, and storage of pesticides; water discharge permitting; and statewide land use zoning. There are existing facilities for radioactive material disposal, and facilities for disposal of other hazardous wastes are being developed.

High-level radioactive wastes may not be disposed of within the State, but low-level disposal is permissible. Unique features of South Carolina environmental regulation include the requirement that wastewater receive at least three levels of treatment and even then not be discharged on the coastline; also, all State permits (which are required) for processing and disposal of wastes must be accompanied by facility and process designs prepared by a registered professional engineer or geologist.

There appears to be no key agency to handle implementation of a hazardous waste management system as existing controls are widely dispersed among several agencies, although responsibilities appear clearly defined. A State Planning Agency (with no regulatory power) has, as in many of the other States surveyed, overall responsibility to coordinate and review plans of other State agencies. Groundwater pollution from landfills is the responsibility of the Water Resources Commission, whereas the Pollution Control Authority is responsible for issuing air, water, and solid waste disposal permits. The Department of Health controls garbage and sewage and also radioactive material disposal. Land use is controlled by local agencies except for the shoreline.

The PCA supervised the design and construction of a new waste treatment plant that officials hoped would be included among plants envisioned under Section 212 of PL-91-512.

Highlights

- Legislation is currently being drawn up which would regulate toxic pesticide wastes.

- Current regulation requires secondary and tertiary treatment and prohibits discharge of wastewater on coastline.

- High-level radioactive wastes may not be disposed of within the State although disposal of low-level wastes is permitted.
- State issues permits for processing and disposal of wastes. All permits must be accompanied by facility and process design prepared by a registered professional engineer or geologist.

AGENCY RESPONSIBILITY

SOUTH CAROLINA	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
PUBLIC HIGHWAY DEPARTMENT	STATE CODE IS LITTER ORIENTED. S.C. CODES 46-660, 46-661, 33-452	NO RESPONSIBILITY	NO RESPONSIBILITY
WATER RESOURCES COMMISSION	OVERALL RESPONSIBILITY TO EVALUATE ENVIRONMENTAL IMPACT STATEMENTS		RESPONSIBLE FOR DETERMINING GROUND WATER SEEPAGE IN LANDFILL AREAS
DEPARTMENT OF HEALTH	ENFORCES DOT REGULATIONS. INTRASTATE TRANSPORT RESPONSIBILITY TO CONTROL, EQUIPMENT AND PROVIDE TRAINING.	PROCESSING RESPONSIBILITY FOR GARBAGE AND SEWAGE	SITE CONTROL RESPONSIBILITY OF GARBAGE AND SEWAGE
DEPARTMENT OF PUBLIC UTILITIES AND PUBLIC UTILITY COMMISSION	NO RESPONSIBILITY UNDER PRESENT LAWS AND CHARTERS BUT INTERESTED IN PROCESSING REGULATIONS, SITE SELECTION AND LAND USE CODES		
DEPARTMENTS OF ECOLOGY AND ENVIRONMENTAL QUALITY, POLLUTION CONTROL AUTHORITY	NO RESPONSIBILITY	ISSUES PERMITS FOR PROCESSING AND DISPOSAL OF WASTE. ALL PERMITS MUST BE ACCOMPANIED BY FACILITY AND PROCESS DESIGN PREPARED BY REGISTERED PROFESSIONAL ENGINEER OR GEOLOGIST	
DEPARTMENT OF MOTOR VEHICLES	NO RESPONSIBILITY	NO RESPONSIBILITY	NO RESPONSIBILITY
DEPARTMENT OF AGRICULTURE	NO RESPONSIBILITY	DR. SENN HAS AWARDED CONTRACT TO CLEMSON UNIVERSITY TO ESTABLISH FEASIBILITY OF DEVELOPING FEED-LOT SOLID WASTE TREATMENT PLANT AND DISPOSAL SYSTEM	
STATE PLANNING AGENCIES	OVERALL RESPONSIBILITY TO COORDINATE AND REVIEW PLANS OF ALL STATE AGENCIES. NO REGULATORY POWER.		

TEXAS

The most distinctive barriers to Texas' acceptance of a national hazardous waste management system are that State's strongly independent attitude (which precludes any inclination toward establishment of such a system) and the existence of the Texas Railway Commission and its sphere of influence. The characteristic Texas independence would necessitate a public relations education program of major proportions for the citizenry to accept a Federally designated site; the Commission's powerful presence makes Texas probably the only State in the nation in which the Interstate Commerce Commission is not the ultimate agency in regard to regulation of transportation. The Commission regulates the transportation, processing, storage, and disposal of the vast amount of waste that is generated as a result of the activities of the petroleum industry and it also regulates the disposition of saltwater and brines associated with oil production. Although DOT regulations are adopted for transportation, the Commission is the chief adminstrator of these.

Specifically lacking regulation in Texas are the disposal and transportation of pesticides, shoreline land use, safety regulations for the handling of hazardous materials, and the disposal, transportation, processing, and storage of explosives. The last of these is surprising, in view of the widespread use of explosives in the State's prime industry, petroleum.

The State Department of Health's Divisions of Air, Water, Solid Waste, and Radiation regulate indirectly on broad authorizations, some of which are overlapping. Responsibility appears to be based more on tradition and politics than on rational functionality--e.g., the Water Quality Board has responsibility for regulating all sources of water pollution with the exception of those regulated by the Railroad Commission, and the WQB has control over industrial solid waste disposal if the industries' own property is being used; however, if public lands are being utilized, the State Highway Department has control. Although any municipality, county, or private contractor can go into the solid waste disposal business, no area can be required to implement a solid waste treatment system.

Texas follows AEC regulations and guidelines for radioactive wastes, but disposal must be on State or Federal land; the State Land Office, which approves the use of all land in the State, will not allow any land to be used as a burial ground for radioactive material, especially high-level material.

Highlights

- Legislation now exists for the manufacture and use but not for the treatment and disposal of hazardous wastes.
- The Railroad Commission is the political and administrative power for the regulation and enforcement of policy concerning transportation, processing, disposal, and storage of oil and gas, including deep well injection, a common practice in Texas.
- At present no area can be forced to initiate a hazardous waste disposal system.
- Texas follows AEC guidelines on the handling of nuclear wastes; however, they must be handled on State or Federal land.
- Air quality is regulated through the issuance of permits for new or modified facilities.

AGENCY RESPONSIBILITY

STATE TEXAS

<table>
<tr><th></th><th>TRANSPORTATION</th><th>PROCESSING</th><th>DISPOSAL/STORAGE</th></tr>
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<tr><td>STATE DEPARTMENT OF HEALTH
AIR
WATER
SOLID WASTE
RADIATION</td><td colspan="3">THE DEPARTMENT HAS NO LEGISLATION OR REGULATION SPECIFICALLY REGULATING HAZARDOUS WASTE, BUT STATE LAWS AND THE REGULATIONS OF THE FOUR DIVISIONS LISTED ARE SUFFICIENTLY BROAD TO REGULATE.</td></tr>
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</table>

VERMONT

Vermont is probably the most unregulated State of any studied, partially because of its traditional independent conservatism but mostly because it is not heavily industrialized and hence little hazardous waste is generated.

Vermont appears to be disinclined toward establishment of a national hazardous waste disposal site, but would welcome technological assistance in developing ways to dispose of hazardous materials.

The State has few actual regulations, controlling environmental pollution mainly through establishment of guidelines and cooperation among those generating wastes. Most industrial wastes now are shipped to New Jersey for processing and disposal and wastes from out of State would not be accepted; however, Vermont would welcome a site and plan for disposal of its own industrial wastes.

Areas in which regulation is in effect include requirements of ambient air and water quality standards and discharge permits for these; the disposal, transportation, processing, and storage of radioactive materials and explosives; the disposal of pesticides; shoreline regulation and city, county, and State zoning for land use; and transportation, in which DOT regulations have been adopted. An area not yet clearly defined but under development is the handling of hazardous materials to meet industrial safety standards.

There is no effective regulation at present of disposal or licensing of sites for solid waste disposal, emissions of air and water, or the transportation, processing, and storage of pesticides. No facilities presently exist for disposal of radioactive or other hazardous waste materials.

The key agency in any implementation of a national hazardous waste disposal site would be the Agency of Environmental Conservation which is developing a plan for the operation of Statewide waste recycling and is also establishing land use planning through the Regional Environmental Commissions and the State Environmental Commissions. This Agency sets the air, water, and solid waste standards and assists the Regional Environmental Commissions in land use decisions.

There is a potent local input into land use planning and a strong impact from local citizens is felt on decisions. Planning is geared to selected growth compatible with environmental goals.

OSHA regulations are being adopted by the Department of Health which regulates the storage and disposal of radioactive wastes and administers the licensing of all radioactive material handlers.

A unique problem receiving concentrated attention is the pollution of Lake Champlain in the vicinity of the oil port of Burlington by spills from barges traveling from Albany. New England Interstate Water Pollution Control Federation oil regulations are to be used as a guide in developing legislation.

Highlights

- Popular and political opinion is against a national disposal site and any hazardous material storage in Vermont, although the State would welcome guidelines for handling hazardous wastes.
- Regulations stipulate that hazardous waste disposal sites would require special approval.
- There are no regulations, only guidelines.
- Licensing of all radioactive material for transport is required.
- Rules and regulations, where applicable, conform to Interstate Commerce Commission rules.
- It is unlawful to transport wastes from out of the State into Vermont for disposal.
- Regulations pertaining to handling of hazardous materials and OSHA regulations have been recently adopted.

AGENCY RESPONSIBILITY

VERMONT	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
DEPARTMENT OF AGRICULTURE	SETS STANDARDS FOR SHIPMENT OF PESTICIDES		HAS NOT COLLECTED BANNED PESTICIDES BECAUSE CURRENT DISPOSAL TECHNOLOGY IS NOT ADEQUATE SPECIFIES PROCEDURES FOR DISPOSAL OF PESTICIDES PESTICIDE BARRELS ARE USUALLY SENT OUT OF STATE FOR REPROCESSING
DEPARTMENT OF HEALTH	REQUIRES LICENSING TO TRANSPORT RADIOACTIVE MATERIAL	REQUIRES ALL PROCESSING AND MANUFACTURING PLANTS TO COMPLY WITH OSHA REGULATIONS FOR OCCUPATIONAL HEALTH AND SAFETY REQUIRES LICENSE FOR USE OR PROCESSING OF ANY RADIOACTIVE MATERIAL HAS AUTHORITY TO DETERMINE THAT A SOURCE OF POLLUTION EXISTS AS A HAZARD TO THE PUBLIC HEALTH CAN FORCE POLLUTION ABATEMENT	REGULATES STORAGE AND DISPOSAL OF SOURCE OF IONIZING RADIATION REQUIRES LICENSING OF ALL RADIOACTIVE MATERIAL HANDLERS
AGENCY OF ENVIRONMENTAL CONSERVATION		ALLOW OPEN BURNING (UPON APPROVAL) IN REMOTE AREAS TO DISPOSE OF "HIGHLY EXPLOSIVE" OR UNUSED MATERIALS FOR WHICH THERE IS NO OTHER FEASIBLE METHOD OF DISPOSAL EVALUATES HAZARDOUS PARTICULATE EMMISSIONS ON A CASE BY CASE BASIS. CONTROLS ODOR EMMISSIONS FROM INDUSTRIAL PROCESSES DEVELOPING STATE PLAN FOR THE DEVELOPMENT AND OPERATION OF WASTE RECYCLING THROUGHOUT THE STATE. CENTERS TO BE USED FOR STORAGE, PROCESSING AND SALE OR DISPOSAL OF ALL SOLID WASTE ESTABLISHING LAND USE PLANNING THROUGH THE REGIONAL ENVIRONMENTAL COMMISSIONS AND THE STATE ENVIRONMENTAL COMMISSIONS SETS WATER QUALITY STANDARDS INCLUDING TOXIC, CHEMICAL AND RADIOLOGICAL MATTER DEVELOPED A PLAN FOR ABATEMENT AND CONTROL OF AIR POLLUTION ESTABLISHED AIR STANDARDS BASED ON NATIONAL CRITERIA	REQUIRES DISCHARGE PERMITS FOR DISPOSAL INTO WATER OR AIR ADVISES COMMUNITIES IN THE LOCATION AND DESIGN OF LANDFILLS ASSISTS THE REGIONAL ENVIRONMENTAL COMMISSIONS IN LAND USE DECISIONS BASED ON LAND CAPABILITY AND ON IMPACTS ON AIR AND WATER QUALITY EXPECT TO DEVELOP A SOLID WASTE BILL FOR THE LEGISLATURE IN THE NEAR FUTURE
DEPARTMENT OF PUBLIC SAFETY	PROMULGATES RULES TO PREVENT EXPLOSION AND FIRE AND MAINTAIN PUBLIC SAFETY IN THE TRANSPORT OF EXPLOSIVES, FLAMMABLES, HAZARDOUS MATERIALS AND PETROLEUM PRODUCTS MAY PRESCRIBE LOCATION AND MATERIALS USED FOR HANDLING SUCH MATERIAL RULES AND REGULATIONS CONFORM TO THOSE OF THE INTERSTATE COMMERCE COMMISSION SAFETY STANDARDS FOR VEHICLES CONFORM TO STANDARDS FOR TANK VEHICLES FOR FLAMMABLE AND COMBUSTIBLE LIQUIDS OF THE NATIONAL FIRE PROTECTION STANDARD	DEVELOP RULES FOR PREVENTION OF EXPLOSION AND FIRE IN THE USE AND MANUFACTURE PRESCRIBE LOCATION, MATERIAL AND TYPE OF CONSTRUCTION	
MISCELLANEOUS	MOST INDUSTRIAL WASTES ARE NOW SHIPPED OUT TO NEW JERSEY UNLAWFUL TO DISPOSE OF COMMERCIAL OR RESIDENTIAL WASTES TRANSPORTED IN FROM OUTSIDE THE STATE	THERE IS A VERY STRONG LOCAL INPUT INTO THE LAND USE PLAN. LOCAL CITIZENS HAVE A STRONG IMPACT ON DECISIONS THE LEVEL OF INDUSTRY IN THE STATE IS NOT HIGH-- FEW HAZARDOUS WASTES ARE GENERATED MOST INDUSTRIAL WASTES ARE NOW PROCESSED IN NEW JERSEY PLANNING IS GEARED TO SELECTED GROWTH WHICH IS COMPATIBLE WITH ENVIRONMENTAL GOALS	THE STATE WOULD WELCOME ASSISTANCE IN DEVELOPING WAYS TO DISPOSE OF HAZARDOUS MATERIALS

VIRGINIA

The most significant factor in Virginia's eventual acceptance of a national site is the fact that determination of its land use policies is scattered through so many State and local agencies. This circumstance correlates with the resistance of the citizenry and local government to "outside" regulation of the affairs of their particular locale. State officials feel that one of their major problems is public response to the disposal of waste materials, including a particularly strong resistance to importing wastes, not only from other States but even from other communities.

The Department of Health is apparently the key State agency in any implementation of a national hazardous waste disposal site; it currently regulates solid radioactive waste disposal and generally controls the disposal of those hazardous materials that are regulated. The State Air Quality Control Board and the State Water Control Board set standards and have limited authority. Since there are less than 100 major industrial firms in the State and these firms practice good procedures, there is little waste to dispose of in Virginia waters.

Pesticides have been a problem but a disposal site is under development which is expected to alleviate this. There is no radioactive disposal site at present.

Among the areas of environmental control not regulated are the transportation, processing, and storage of pesticides; air and water emissions; licensing of solid waste disposal sites; safe handling of hazardous materials (under development); and statewide land and shoreline use zoning.

More than half the counties of Virginia have zoning power but use it ineffectively. However, the very strong role played by local government in deciding upon land use precludes the development of a statewide policy. An official of the Office of State Planning noted the lack of "muscle" in its authority to adequately establish plans for the State; the OSP has little legislation or regulative authority, but apparently is intended to fulfill an advisory role. Development of a stronger State land use plan would be imperative for eventual acceptance of a national disposal site.

Highlights

- Water Control Board must evaluate and approve all disposal sites if they influence surface or ground water.
- Ineffective zoning power held by 60 percent of counties.

- Land use policies are scattered through many State agencies and should be consolidated.
- Air and water quality standards are set.
- Regulations exist for transporting explosives and other dangerous materials, registration of pesticides, discharge permits for waste disposal, and disposal of radioactive material.

AGENCY RESPONSIBLITY

VIRGINIA	TRANSPORTATION	PROCESSING	DISPOSAL/STORAGE	MISCELLANEOUS
STATE CORPORATION COMMISSION	REGULATES PIPELINE CONSTRUCTION REGULATES TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS MATERIALS. (RULES CONFORM TO ICC RULES.)			
DEPARTMENT OF AGRICULTURE	REGISTERS PESTICIDES FOR TRANSPORT IN INTRASTATE MOVEMENT		COOPERATES WITH OTHER STATE AGENCIES IN THE DEVELOPMENT OF DISPOSAL PRACTICES FOR PESTICIDES.	
PLANNING AND COMMUNITY AFFAIRS	REQUIRES LABELING OF HAZARDOUS MATERIALS	IDENTIFYING CRITICAL ENVIRONMENTAL AREAS TO BE PROTECTED	SITE SELECTION WILL BE INFLUENCED BY THE CRITICAL ENVIRONMENTAL AREAS STUDY	HAVE LITTLE LEGISLATIVE AUTHORITY OR REGULATORS POWER
STATE AIR QUALITY CONTROL BOARD		DEVELOPS A PROGRAM FOR ABATEMENT AND CONTROL OF AIR POLLUTION MAY REQUIRE CONTROL DEVICES ON ANY OR ALL SOURCES MAY GRANT VARIANCES TO THE STANDARDS IF DEEMED WARRANTED		
STATE WATER CONTROL BOARD		SETS WATER QUALITY STANDARDS EVALUATES ALL NEW FIRMS AND FIRMS USING NEW PROCESSES TO DETERMINE WASTE DISPOSAL REQUIREMENTS.	ISSUES DISCHARGE PERMITS FOR WASTE DISPOSAL INTO THE STATE WATERS ASSIST IN THE EVALUATION OF DISPOSAL SITES FROM A WATER QUALITY STANDPOINT PARTICIPATED IN SELECTION OF PESTICIDE DISPOSAL SITE	MAINTAIN A TEAM ON A 24-HOUR BASIS TO INVESTIGATE REPORTED POLLUTION INCIDENTS FEW HAZARDOUS WASTE PROBLEMS IN VIRGINIA WATERS
DEPARTMENT OF HEALTH		CONTROLS SEWAGE TREATMENT FACILITIES JOINTLY WITH STATE WATER CONTROL BOARD	REGULATES AND PLANS FOR SOLID WASTE DISPOSAL CONTROLS DISPOSAL OF HAZARDOUS MATERIALS IN A MANNER APPROVED BY THE HEALTH COMMISSIONER REGULATES DISPOSAL OF RADIOACTIVE MATERIALS	HAS A MAJOR, IF NOT THE MAJOR ROLE IN CONTROLLING HAZARDOUS PROCESSES AND MATERIALS.
MISCELLANEOUS			DIFFICULT TO GET PUBLIC APPROVAL OF LANDFILL SITES A SITE HAS BEEN SELECTED FOR THE BURIAL OF WASTE AND BANNED PESTICIDES THE SITE MAY BE USED FOR OTHER HAZARDOUS WASTES IN THE FUTURE.	LAND USE PLANNING AND ZONING IS GENERALLY NOT VERY EFFECTIVE LAND USE POLICIES ARE SCATTERED THROUGHOUT A NUMBER OF AGENCIES

WASHINGTON

Environmental factors are well regulated in Washington by legislation enacted in the 1970's, including an Environmental Policy Act (1971) modeled after the National Environmental Protection Act. Implementation of a national hazardous waste disposal site would therefore not meet great opposition although several areas would need more thorough regulation.

The Department of Ecology is the key agency in environmental affairs, regulating air and water quality through a comprehensive classification system as well as solid waste disposal. This agency is also presently responsible for what little regulation exists of radioactive materials (mainly disposal). A State Radiation Control Agency is being created by new legislation. Meanwhile the transportation, processing, and storage of radioactive materials is unregulated. Also not regulated are the transportation, processing, and storage of pesticides. The Department of Agriculture regulates pesticide disposal. Facilities exist for both radioactive and other hazardous material disposal.

Two other areas not regulated include the processing of explosives and statewide land use zoning. The cities and counties are authorized to form land use planning commissions and the latter are charged with developing a "master program for regulation of uses of the shorelines of the State" by the passage in the fall of 1972 of the Shoreline Management Act, which requires them to inventory their shorelines by January of 1973. Shorelines are defined as the area between low and high water.

One of the more significant facets of the State EPA is its requirement of all branches of the government that they "include in every recommendation...and action significantly affecting the environment...the environmental impact of the proposed action." This requirement alone if adequately monitored by the Department of Ecology should prevent or resolve any potential or current problems involving the environment.

Washington's geographical position is particularly important from an interstate perspective, so the approval that has been given by the EPA on its air and water quality standards significantly aids implementation of a national site in the Pacific Northwest.

Highlights

- Washington presently has emission and ambient air and water quality standards with permits required for discharge.
- Regional air quality authorities may adopt more stringent standards than those of the State and authorize variances.
- Washington presently regulates the transporting, storage, and disposal of explosives.
- Washington regulates the disposal of solid waste, hazardous materials and pesticides.
- Counties and cities have authority to regulate land use with special regulations for shoreline limitation.
- Hazardous wastes are defined as explosives and medical, radioactive, and harmful chemical wastes.
- Water quality standards have been established and classified into four categories with strict limitations on discharge of toxic, radioactive, and deleterious metals.
- Washington passed by referendum a shoreline management act which requires all counties to inventory and develop guidelines to the master plan regulation for shoreline use.

Law Library Search Findings

Environmental Policy Act

Washington passed an environmental policy act in 1971 which is similar to the National Environmental Policy Act. In particular, all branches of State government are directed to "include in every recommendation...and actions significantly affecting the quality of the environment...(1) the environmental impact of the proposed action..." RCW 43.21.

Solid Waste Disposal

The Department of Ecology administers Washington solid waste law. All counties are now in the process of preparing long term comprehensive solid waste disposal plans for submission to the Department. RCW 70.95.080.

Applications for solid waste disposal sites must be approved by the Department. RCW 70.95.180. Applications must include an environmental impact statement. WAC 173-301-181. The Department has approved minimum functional standards for solid

AGENCY RESPONSIBILITY

WASHINGTON	TRANSPORTATION	PROCESSING	STORAGE/DISPOSAL
STATE PATROL	HAS ADOPTED DOT REGULATIONS FOR SURFACE TRANSPORTATION OF HAZARDOUS MATERIALS.[1]		
DEPARTMENT OF ECOLOGY		EMISSION AND AMBIENT AIR AND WATER QUALITY STANDARDS HAVE BEEN ADOPTED. PERMITS ARE REQUIRED FOR DISCHARGE OF WATER POLLUTANTS.[2] WATERS IN THE STATE HAVE BEEN PLACED IN FOUR CLASSIFICATIONS. EACH HAS A PERMISSIBLE LEVEL OF TOXIC CHEMICALS. AIR EMISSION STANDARDS HAVE BEEN SET BY THE DEPARTMENT FOR SEVERAL CHEMICALS AND INDUSTRIAL PROCESSES. REGIONAL AIR QUALITY AUTHORITIES MAY ADOPT STANDARDS MORE STRICT THAN THOSE SET BY THE DEPARTMENT. EMPLOYERS MUST MAINTAIN A SAFE WORK ENVIRONMENT FOR EMPLOYEES.[4] WORK ENVIRONMENT OF EMPLOYEES ENGAGED IN EXTRA-HAZARDOUS ACTIVITIES MUST BE INSPECTED ONCE A YEAR.	HAS ISSUED REGULATIONS FOR SOLID WASTE DISPOSAL. SPECIAL STORAGE REQUIREMENTS AND PRIOR DEPARTMENT APPROVAL ARE REQUIRED FOR DISPOSAL OF HAZARDOUS MATERIALS.
DEPARTMENT OF LABOR AND INDUSTRIES	THIS DEPARTMENT HAS ISSUED REGULATIONS FOR THE TRANSPORTATION, STORAGE, AND DISPOSAL OF EXPLOSIVES.		
DEPARTMENT OF AGRICULTURE			REGULATIONS FOR DISPOSAL OF PESTICIDES AND THEIR CONTAINERS HAVE BEEN ADOPTED.
MISCELLANEOUS		THE WASHINGTON STATE ENVIRONMENTAL POLICY ACT OF 1971 IS SIMILAR TO NEPA. IN PARTICULAR, IMPACT STATEMENTS ARE REQUIRED FOR STATE ACTIVITIES SIGNIFICANTLY AFFECTING THE ENVIRONMENT.	COUNTIES AND CITIES ARE AUTHORIZED TO ZONE. COUNTIES IN THE STATE ARE PRESENTLY IN THE PROCESS OF ADOPTING REGULATIONS FOR LAND USE IN SHORELINE AREAS.

[1] THE PATROL HAS APPLIED 49CFR 171-178 AND 390-397 TO REGULATE SURFACE TRANSPORTATION OF HAZARDOUS MATERIALS.

[2] RCW 90.48.160

[3] RCW 90.58.080

[4] RCW 49.16.090

waste handling. The regulations became effective on November 24, 1972.

Wastes defined as hazardous include explosives and medical, radioactive, and harmful chemical wastes. WAC 173-301-110(11). Hazardous wastes must be properly labeled and stored so as to be inaccessible to the public. WAC 173-301-123. The distance separating hazardous wastes and the bottom of a sanitary landfill is determined on a case by case basis. WAC 173-301-302.

Air Pollution

Statewide air pollution authority is vested in the Department of Ecology. Air pollution is declared to be unlawful except as specified in a variance permit. RCW 70.94.040.

Each county has an air pollution control authority. Many counties have joined to form regional authorities pursuant to RCW 70.94.057. Authorities may classify air contaminant sources and require reporting of emissions. RCW 70.94.151, .152. The regional authorities and the Department of Ecology are authorized to grant variances. RCW 70.94.181. Rules of regional authorities supersede local rules. RCW 70.94.230.

The Department of Ecology is directed to adopt minimum ambient and emission standards throughout the State. Regional authorities may adopt more stringent standards. RCW 70.94.331(6). The Department may adopt statewide standards for particular emissions or particular industrial processes. RCW 70.94.395. The Department has adopted regulations for several chemicals and for several industrial processes.

Washington's air quality implementation plan was fully approved by EPA prior to the recent nondegradation court case.

Water Pollution

The Washington Department of Ecology is authorized to control and prevent pollution of State waters and to promulgate regulations to accomplish this purpose, RCW 90.48.030, .035. A permit from the Department must be obtained before discharging any liquid or solid wastes into State waters. RCW 90.48.160. The Department can order a halt to discharge when necessary. RCW 90.48.240.

Interstate water quality standards have been fully approved by EPA and the following intrastate classifications have been established: class AA, extraordinary; class A, excellent; class B, good; and class C, fair. All State waters fall into one of these classifications. Water quality criteria have been established for each classification. One criterion is toxic, radioactive, or deleterious material concentration. A similar classification scheme exists for interstate waters.

Land Use

Washington has a State land planning commission. RCW 43.287. The commission's primary function is to present a model land use code to the forty-third session of the State Legislature (1973).

County Planning

The board of commissioners in any county may create a planning commission or department. RCW 36.70.030, .040. Counties and cities may also create regional planning commissions. RCW 36.70.060.

Each planning agency is directed to prepare a comprehensive plan. RCW 36.70.320. Wide flexibility is permitted in plan elements. RCW 36.70.330-.350. A public hearing, RCW 36.70. 380, must precede approval by the board. Zoning is permitted if the plan contains a land use element. RCW 36.70.720.

City Planning

Cities are authorized to form planning commissions and zone in much the same manner as counties. RCW 35.63. Alternatively cities may cooperate with counties and form regional planning commissions. RCW 35.36.070.

Washington voters approved a shoreline management act as a referendum in the November 7, 1972 election. The act requires all counties in the State to inventory the shorelines (the areas between high and low water) of major bodies of water by January 1, 1973. RCW 90.58.080(1). Counties are also required to develop "a master program for regulation of uses of the shorelines of the State" consistent with guidelines issued by the Department of Ecology. RCW 90.58.080(2). A permit is required for substantial shoreline developments. RCW 90.58.140.

Nuisances

A nuisance is defined in general terms in RCW 7.48.120. Public nuisance is defined in RCW 9.66.010 and specific public nuisances enumerated in RCW 7.48.140.

Explosives

The Washington State Explosives Act was passed in 1971. It authorizes the department of labor and industries to issue regulations concerning the "...use, transportation, storage, and disposal of explosives." The statute gives detailed criteria for storage of explosives. Explosive containers must be clearly marked. RCW 70.74.300. Transportation of less than 50 pounds is permitted in passenger vehicles; transportation in excess of 50 pounds must be in accordance with Department of Transportation rules.

Pesticides

Authority for regulation of pesticide use is vested in the Department of Agriculture. The Department has issued regulations stating that pesticides must be disposed of in a non-polluting manner and without endangering persons or food supplies. WAC 16-222-150, 16-235-020(2). Requirements are also specified for unattended pesticides and their containers. WAC 16-235-020(4).

Radiation

Legislation creating a State radiation control agency is included. Nothing in the legislation specifically bears on transportation or disposal of radioactive material.

Transportation of Hazardous Materials

The Washington State Patrol has been given authority to regulate the highway transportation of hazardous materials. RCW 46.48.170. Washington has also adopted 49 CFR 171-178 and 390-397.

Industrial Safety

RCW 49.16.030 is a general statute imposing a duty on employers to maintain a safe working environment for employees. The Director of Labor and Industries is required to promulgate safety standards. RCW 49.16.050. The Division of Safety within the Department of Labor and Industries is directed to inspect the work environment of employees engaged in extra-hazardous work at least once a year. RCW 49.16.120.

APPENDIX O

POTENTIAL RADIOLOGICAL TOXICITIES ASSOCIATED WITH RADIOACTIVE WASTES

Most of the potential toxicity from radioactive wastes arises from radioactive decay rather than from chemical toxicity; therefore waste toxicities vary significantly according to storage time and comparisons of curies in radioactive wastes at the time of disposal is meaningless in terms of long-term radiological safety.

The toxicity of radioactive wastes can be typified by those of wastes from the nuclear power fuel cycle, which will most likely provide the largest source of radioactive wastes by the year 2000.

The nuclear fuel cycle can be subdivided into seven major components (exclusive of radioactive waste management and transportation): mining, milling, uranium hexafluoride production, enrichment, fuel fabrication, nuclear reactors, and irradiated fuel reprocessing. Each of these components generates its own associated radioactive wastes. To help develop a perspective on the potential hazards associated with wastes from irradiated fuels, wastes from the fuel reprocessing and refabrication plants are compared here with the wastes from the uranium mining and milling industry.

Projections through the year 1980 indicate that about 8,500 metric tons of irradiated fuel will be discharged from the nuclear power economy, mostly from light water reactors with uranium fuel slightly enriched in U-235. The bulk of the planning being fostered by the AEC is being made for wastes from a nuclear economy through the year 2000. By that time a total of 167,600 metric tons, or 20 times the amount discharged through 1980, will have been discharged. At least 838,000 metric tons of uranium would have to be mined, milled, converted to UF_6 and fed to the enrichment plants to produce enough slightly enriched uranium for charging the reactors. But more efficient alternative sources of fissionable material will become available, and it is projected that only 70 percent of the accumulated discharge of fuel will come from reactors with slightly enriched U-235 fuel; the remainder will be from plutonium recycle reactors (4.3 percent), U-233-thorium-fueled gas cooled reactors (10.1 percent), and fast breeder reactors (15.2 percent). Distributions of the radioactive actinide elements in the wastes from these reactors are different from those of current uranium-fueled light water reactors.

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Radionuclide concentration guides (RCG's) for radionuclides in drinking water and air are provided in 10 CFR 20. However, these numbers alone do not give any estimate of the total dose to man because of the various environmental pathways and concentration of some nuclides in food chains leading to ultimate human ingestion. Estimation of the total dose to man requires a complex analysis of specific waste release situations and the specific pathways to man. A model has been developed by Battelle-Northwest for estimating the total dose to man from given release modes and rates to the environment.[A-67] This model has been useful in preparing environmental impact statements for nuclear reactors. An idea of the complexity involved can be obtained from Figure A-21.[A-67] Clearly, inhalation and drinking water are only two of the many pathways to ingestion. To provide rates of release to man's environment requires analyses of the rate of release from the facility and the rate of travel from the facility (e.g., through the lithosphere to surface water, if the radionuclides are buried).

A method for estimating the order of magnitude of potential toxicity associated with radioactive wastes is to calculate the amount of water required for dilution to bring the waste concentration down to the RCG for drinking water.[A-67] Results of these calculations are presented in Figure A-22 for the accumulated high level wastes from the nuclear economy's fuel reprocessing plants through the year 2000 if the wastes are stored for periods from one year to one billion years. Magnification via food chains would be expected to change the relative toxicity of the various radionuclides.

The potential drinking water toxicity due to 838,000 metric tons of aged natural uranium equivalent to the fuel charged to the reactors is also shown in Figure A-23. It is important to note that the relative toxixity of the total of the fission products (versus the actinide products) decays to an equivalent of the original uranium in less than 1,000 years. The I-129 potential hazard is smaller than the natural uranium hazard associated with uranium mining and milling.

Similar calculations have been made for various fractions of the waste constituents from nuclear fuel reprocessing such as the transplutonium nuclides, the 0.5 percent fraction of plutonium lost to the waste, the fuel element cladding, and the 0.5 percent fraction of uranium-thorium fuel in the waste. The results presented in Figure A-23 indicate that various fractions of the wastes may be controlling at different cooling times.

The above treatment is far from complete. Potential drinking water toxicities do not include inhalation and an analysis of

FIGURE A-21

DOSE CALCULATION MODEL

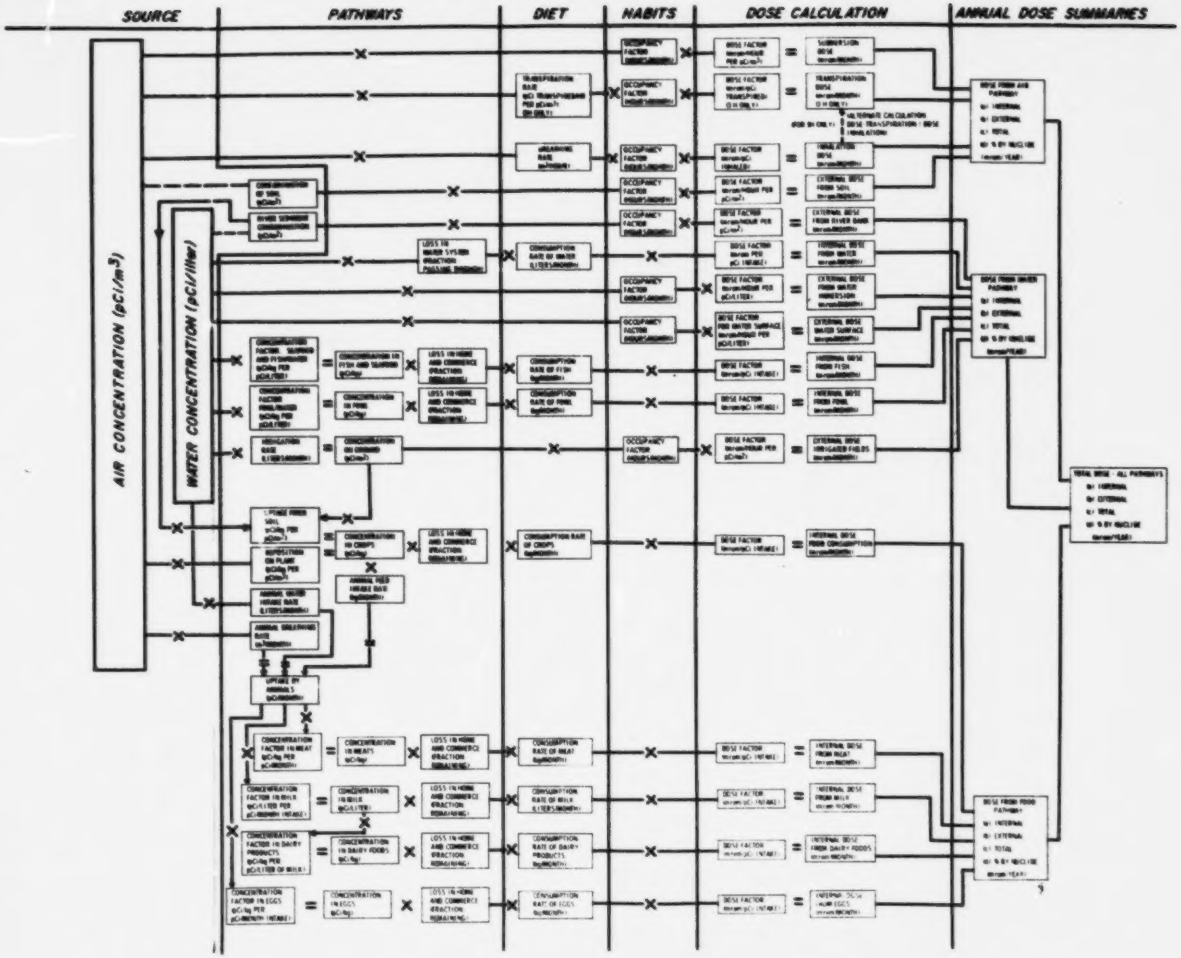

SOURCE
PATHWAYS
DIET
HABITS
DOSE CALCULATION
ANNUAL DOSE SUMMARIES
AIR CONCENTRATION (pCi/m³)
WATER CONCENTRATION (pCi/liter)
OCCUPANCY FACTOR
DOSE FACTOR
SUBMERSION DOSE
TRANSPIRATION DOSE
ALTERNATE CALCULATION DOSE TRANSPIRATION / DOSE INHALATION
INHALATION DOSE
EXTERNAL DOSE FROM SOIL
EXTERNAL DOSE FROM RIVER BANK
INTERNAL DOSE FROM WATER
EXTERNAL DOSE FROM WATER IMMERSION
EXTERNAL DOSE WATER SURFACE
INTERNAL DOSE FROM FISH
INTERNAL DOSE FROM FOWL
EXTERNAL DOSE IRRIGATED FIELDS
INTERNAL DOSE FROM CONSUMPTION
INTERNAL DOSE FROM MEAT
INTERNAL DOSE FROM MILK
INTERNAL DOSE FROM DAIRY FOODS
INTERNAL DOSE FROM EGGS
DOSE FROM AIR PATHWAY
DOSE FROM WATER PATHWAY
DOSE FROM FOOD PATHWAY
TOTAL DOSE - ALL PATHWAYS
a) INTERNAL
b) EXTERNAL
c) TOTAL
d) % BY NUCLIDE
LOSS IN WATER SYSTEM
CONSUMPTION RATE OF WATER
CONCENTRATION IN FISH AND SEAFOOD
CONCENTRATION IN FOWL
IRRIGATION RATE
CONCENTRATION ON GROUND
UPTAKE FROM SOIL
DEPOSITION ON PLANT
CONCENTRATION IN CROPS
ANIMAL FEED INTAKE RATE
ANIMAL WATER INTAKE RATE
ANIMAL BREATHING RATE
UPTAKE BY ANIMALS
CONCENTRATION FACTOR IN MEAT
CONCENTRATION IN MEATS
CONCENTRATION FACTOR IN MILK
CONCENTRATION IN MILK
CONCENTRATION FACTOR IN DAIRY PRODUCTS
CONCENTRATION IN DAIRY FOODS
CONCENTRATION FACTOR IN EGGS
CONCENTRATION IN EGGS
LOSS IN HOME AND COMMERCE (FRACTION REMAINING)
CONSUMPTION RATE OF FISH
CONSUMPTION RATE OF FOWL
CONSUMPTION RATE OF CROPS
CONSUMPTION RATE OF MEAT
CONSUMPTION RATE OF MILK
CONSUMPTION RATE OF DAIRY PRODUCTS
CONSUMPTION RATE OF EGGS
BREATHING RATE
TRANSPIRATION RATE

FIGURE A-22

POTENTIAL RADIOLOGICAL TOXICITY OF NUCLEAR FUEL WASTES
AS A FUNCTION OF AGING

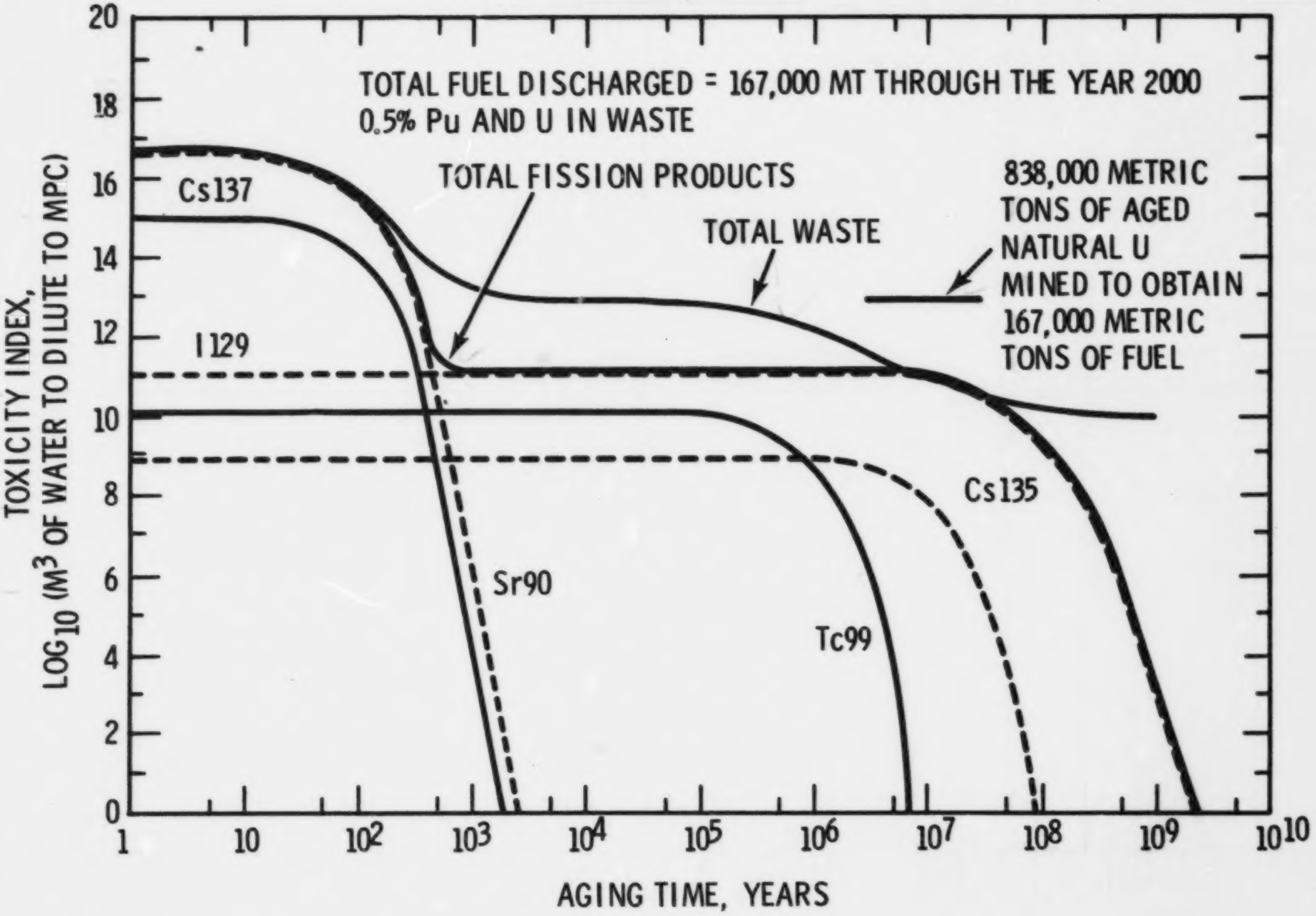
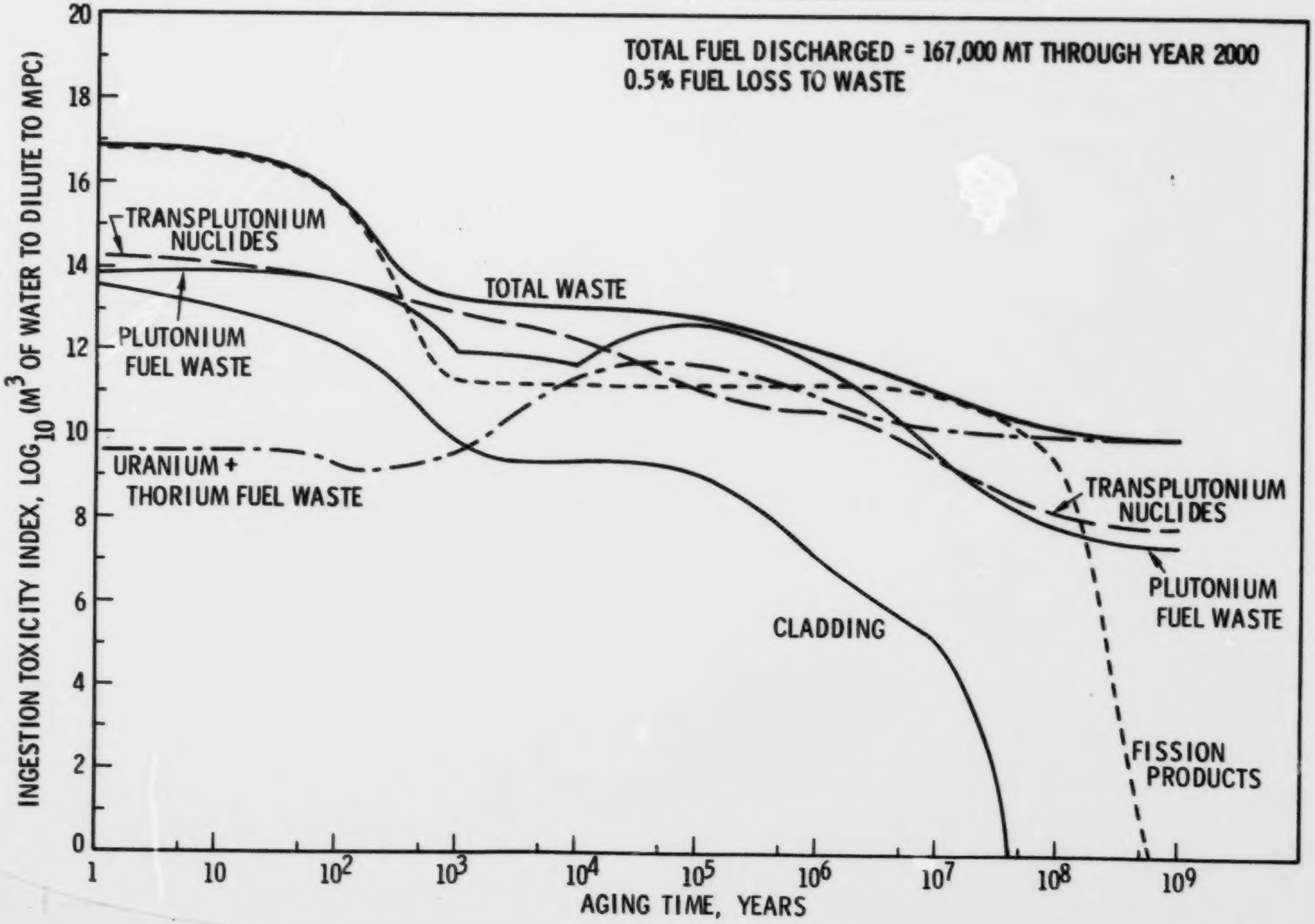


FIGURE A-23

TOTAL NUCLEAR ECONOMY THROUGH YEAR 2000



the environmental pathways via food chains nor do they include the protection afforded by containment and isolation. In addition, no comparison with normal chemical toxicities of the wastes has been made here. The mechanism and rate of release to man's environment are not included. More complete analysis of causes and effects would produce a better perspective of high-level and low-level radioactive wastes and the potential risk to man.

APPENDIX P

DETAILED INVENTORY OF A SELECTED AEC SITE
HANFORD, WASHINGTON

The Hanford Reservation was selected as an example of the complex interactions involved in radioactive waste management at an AEC site. The Reservation occupies 600 square miles of an arid plateau near the Columbia River in Southeastern Washington and is fully integrated, containing nine reactors, fuel processing plants and research and development laboratories.

The Atlantic Richfield Hanford Company, which operates the fuel reprocessing plants (known as the 200 Areas), also handles the bulk waste disposal for the other AEC contractors which are Battelle-Northwest (laboratories for several AEC divisions), Westinghouse Hanford Company (laboratories for AEC's Division of Reactor Development and Technology), and United Nuclear Industries(reactors and fuel fabrication). Eight of the reactors have been deactivated during the past ten years and the ninth reactor will probably be closed within five years. The residual radioactive structural materials associated with the reactors remains in place.

Developments on the site and being planned include an existing commercial radioactive waste burial ground, at least two commercial nuclear power reactors, a large sodium-cooled test reactor, and 300,000 gallons of radioactive sodium shipped from the Hallam reactor in Nebraska.

The effluents from the fuel processing plants are summarized yearly by a computerized data organization system[A-68-A-70] with samples on a monthly basis. The statistics for 1971 are summarized in Table A-95.

For gaseous wastes the sampling points mainly included stacks and vault storage off-gas emissions. A total of 52 separate identifiable release points to the atmosphere were monitored.

The liquid wastes are discharged into ponds and ditches, cribs (specially designed French drains), and specific retention sites. Pond discharges have low radioactivities, those to cribs are somewhat higher, and specific retention sites have the highest activity but the wastes are considered to be confined. Seventeen distinct discharge points to ponds, ditches and cribs are identified, and 19 specific retention sites are used. Total accumulative amounts of liquids discharged through 1971 are given in Table A-96. High-level liquid wastes are

A-91

TABLE A-95

RADIOACTIVE WASTE DISCHARGES FROM THE 200 AREAS OF THE HANFORD PLANT DURING 1971

Gaseous Wastes Discharged to Atmosphere

Total Volume of Gases	4.33×10^{12} cubic feet

Radioactivity

Alpha (assumed source - Pu)	4.17×10^{-2} Ci
Alpha (assumed source - U)	1.25×10^{-2} Ci
Beta	1.33 Ci
Iodine-131	0.204 Ci

Liquid Wastes Discharged to Ground

Total Volume of Liquids	6.49×10^{9} gallons
To ponds and ditches	6.29×10^{9} gallons
To cribs	2.01×10^{8} gallons
To specific retention sites	2.34×10^{5} gallons

Radioactivity

Pu	6771 grams
Beta	5700 Ci
Sr-90	60 Ci
Ru-106	3300 Ci
Cs-137	<1170 Ci
Co-60	< 9.5 Ci
U	< 140 Ci
U-233	< 117 Ci

Solid Waste Burials

Volume of Solid Wastes Buried	1.55×10^{5} cubic feet
Land Surface Area Used for Burial	2.08×10^{5} square feet

Radioactivity

Uranium	1.12×10^{6} grams
Plutonium	3.8×10^{3} grams
Other radioactivity	$<1.48 \times 10^{4}$ Ci

TABLE A-96

ACCUMULATED LOW-LEVEL LIQUID AND SOLID RADIOACTIVE WASTES IN THE HANFORD 200 AREAS THROUGH 1971

Liquid Wastes Discharged	
Volume	1.32×10^{11} gallons
Radioactivity	
Plutonium	286,330 grams
Beta	3.21×10^{6} Ci
Sr-90	4.51×10^{4} Ci
Ru-106	5.57×10^{5} Ci
Cs-137	5.01×10^{5} Ci
Co-60	$<7.3 \times 10^{3}$ Ci
Uranium	1.173×10^{5} kg
U-233	$<$ 967 grams
Solid Wastes in Burial Grounds	
Volume	5.19×10^{6} cubic feet*
Acres of Land Area	149 acres
Uranium	5.86×10^{8} grams
Plutonium	3.64×10^{5} grams
Other Radioactivity	8.67×10^{5} Ci

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* This does not include a much larger volume ($\sim 1.5 \times 10^{8}$ cubic feet) of soil contaminated by liquid discharges.

treated separately by tank storage. Additional liquid wastes have been discharged by United Nuclear Industries at the reactor sites.

Solid wastes are placed in burial grounds, formerly by direct burial or in caissons and now in 55 gallon drums. Approximately 20 burial areas located mainly in two burial gardens are identified. Appreciable contaminated equipment is also stored in underground railroad tunnels. Additional burial grounds exist in reactor areas. The accumulated solid waste burials are given in Table A-96.

Preliminary estimates of the costs of removing the radioactive materials from the Hanford site have been made.[A-71] Reduction of the plutonium levels to values suitable for uncontrolled access could cost billions of dollars and take several decades to complete. Clearly, decommissioning of the site would be a major undertaking, and its designation as a national repository would seem very likely. A comparable situation exists at the Savannah River, South Carolina, site, while the magnitude of the radioactive inventories at ORNL and Idaho are substantial, but appreciably smaller.

The total underground tank storage capacity projected for 1980 at Hanford is 98 million gallons in 153 tanks.[A-72] The working capacity of these tanks is 72 million gallons because none of them can be completely filled under normal operating conditions. The current (end of FY 1972) inventory of wastes stored in these tanks is 65.5 million gallons,[A-73] of which 21.7 million gallons are solid and 43.8 million gallons are liquid.[A-74] All tanks contain both solid sludge and liquid supernates simultaneously.

The principal long-lived radioisotopes in these tanks are Sr-90, Cs-137, and Pu-239. Depending upon the exposure to neutrons in the reactors, the plutonium will also contain varying amounts of Pu-240, Pu-241, Am-241, Pu-242, Am-243, Cm-244 and their decay products. Estimates of the total quantities of radionuclides are available.[A-71] The radionuclide concentrations vary widely from tank to tank but the maximum values are on the order of tens of millions of curies of Sr-90 and Cs-137 per tank. The plutonium contents of the tanks are quite variable, ranging up to kilogram quantities in some tanks, but the total is only a small fraction of the plutonium buried in the ground.

A waste solidification program is underway to reduce the volume of the liquid wastes to less than three million gallons by the end of 1980.[A-70] At that time the solid waste volume in the tanks (including wastes to be generated in the interim at a rate of about seven million gallons of liquid waste per year through FY 1976) will be 47 million gallons (or 6.3 million cubic feet) but it will still be distributed throughout 153 tanks. The bulk of the solids will be $NaNO_3$ with significant quantities of $NaNO_2$, NaOH, $NaAlO_2$, Na_2CO_3 and ferric iron, sulfate, and phosphate.

In addition, separations of the bulk of the heat-generating Sr-90 and Cs-137 from the tank stored wastes are being conducted. These separated fission products will be stored separately in small capsules as solid SrF_2 and CsCl in high-integrity, cooled facilities, with a total salt volume less than 250 cubic feet. Estimates of the total quantities of Sr-90 and Cs-137 to be stored in this way are available.[A-75] After separation, the Sr-90 and Cs-137 capsules can be considered high-level wastes because of their high heat generation rates, while the solidified wastes remaining in the tanks are low-level wastes because no cooling is required. As an environmental hazard, the Sr-90 and Cs-137 in the high-level wastes will decay to insignificant levels within three or four hundred years, but the plutonium in the low-level wastes may require isolation from man's environment for hundreds of thousands of years.

APPENDIX Q

CLASSIFICATION OF RADIOACTIVE WASTES FOR TRANSPORTATION REGULATORY PURPOSES

For transportation regulatory purposes each radioactive nuclide is classed as a member of one of seven transport groups.* Generally, Group I includes the most radiotoxic materials. A special class is provided for "special form" materials, which are massive and solid or encapsulated so as to present little hazard of radiotoxicity. For each transport group five categories of shipments are specified in terms of limits on the quantity or concentration of radioactivity. Each shipment category, in turn, requires a different specified level of assurance of containment integrity.[A-76]

The radioactivity limits for transport of Group I materials are given in the following discussion of these categories. The other groups generally have higher limits.

- "Small quantities" (less than .001 millicuries per package for Group I) are exempt from most of the packaging requirements and need basically only tight packages.

- "Low specific activity" (LSA) materials (less than 0.0001 millicuries per gram for Group I) are dilute materials which may be either packaged or in bulk and are exempt from many packaging requirements, especially when the vehicle is dedicated to the sole use of the consignor. In general only strong, tight packaging is needed. Bulk liquids must be transported in specification tank cars.

- "Type A quantities" (less than 0.001 curies for Group I) must be shipped in packages which can maintain their integrity under normal environmental and handling conditions of transportation. The packages must pass specified functional tests but do not require official approval by DOT or AEC.

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*The concept of transport groups may be eliminated in future revisions of the regulations. In that case limits would be specified for each radioactive nuclide.[A-77]

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- "Large quantities" (greater than 20 curies for Group I) must be shipped in packages which meet both type B requirements and special additional structural requirements of the AEC.[A-78] It is frequently necessary to make special provision for dissipating heat. These packages need approval by both AEC and DOT.

Special regulations of both DOT and AEC apply to fissile material, three classes of which are superimposed on the general categories described above.

Virtually all shipments of high-level wastes will fall into the "large quantities" category and will thus have to pass severe accident and structural tests as well as meet a host of lesser requirements. Shipments of low-level wastes will probably fall in all categories except "small quantities." Types A and B quantities are probably most common for miscellaneous wastes and alpha wastes, with occasional bulk shipments of LSA materials.

Prevention of accidents is the primary purpose of the packaging and transportation regulations. The major burden falls on the shipper who is required to provide a safe package, his safety efforts depending upon the degree of hazard of the contents.

In addition to general regulations applicable to all packages of hazardous materials, there are many specifically applicable only to radioactive materials. All packages must be strong and tight enough to contain the contents, must have a noncontaminated surface and a specified marking or label, and must not emit excessive radiation. Pyrophoric materials must be placed in special inner containers. Radioactive liquids must be packaged in leak-resistant and corrosion-resistant inner containers. A package containing liquids must survive a 30 foot drop test or contain a specified amount of absorbent material. If the package contains a type A quantity, it must maintain its integrity at 130°F and -40°F, at reduced (one-half) atmospheric pressure, under normal vibration conditions, after a 30 minute water spray, after a drop of four feet, after one foot drops on each corner of the package, after impact with a specified steel cylinder, and after a specified 24 hour compression test.

In addition to type A requirements, a type B package must maintain its integrity under the following severe accident conditions: a free drop of 30 feet, a free drop of 40 inches onto a six-inch diameter steel pin, exposure to a 1475°F fire for 30 minutes, and (for fissile materials only) immersion in water for eight hours. In addition, a package containing "large quantities" of radioactive material must dissipate heat safely, have a positive closure and strong lifting and tie-down devices and must withstand a specified static load along any major axis and an external pressure of 25 psig.

All packages for fissile material must have a positive closure, strong lifting and tie-down devices, and must remain subcritical neutronically under a variety of specified conditions involving neutron moderation by water and interaction with other packages of fissile material.

Besides supplying a safe package, a shipper of radioactive materials must follow other procedures intended to prevent accidents. Prior to each shipment of fissile materials the shipper must notify the consignee of the dates of shipment and expected arrival. He must also notify each consignee of any special loading/unloading instructions prior to his first shipment. He must supply shipping papers, including an accurate and quantitative description of the contents of the shipment and a signed certificate of compliance with the applicable DOT regulations.

The DOT regulations require the carrier to take certain measures designed to prevent accidents. In addition to general regulations applicable to all hazardous materials, there are several specifically applicable to radioactive materials. Minimum weights are specified for containers to be loaded on flat cars or in gondola cars, and packages must be blocked and braced to prevent movement under normal conditions.

The number of packages in any vehicle or storage location must be limited to prevent neutron criticality of fissile material or excessive radiation levels due to ordinary radioactive materials. This is done by limiting the sum of transport index numbers (marked on each package by the shipper) to 50.* Packages bearing certain radioactivity labels must not be placed closer than three feet to an area occupied by people or animals. If more than one such package is present, the distance must be increased according to the total transport number of the group.

Radioactive materials may not be stored or loaded with certain types of explosives. Vehicles must be marked or placarded on the outside with an appropriate standard warning sign. Vehicles used for carload or truckload shipments of LSA materials must be surveyed and cleaned to specified levels, unless the vehicles are marked as reserved for radioactive materials.

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*The transport index is the greater of the following two numbers: (1) the highest dose rate in millirems per hour at three feet from the surface of the package, and (2) for Fissile Class II packages only, the number calculated by dividing the number "50" by the number of similar packages that may be transported together.

APPENDIX R

METHODS AND EQUIPMENT FOR HANDLING SMALL RADIOACTIVE WASTE ACCIDENTS AND FOR DECONTAMINATING TRANSPORT SYSTEMS

METHODS AND EQUIPMENT FOR HANDLING SMALL RADIOACTIVE WASTE ACCIDENTS

The stringent containment required by regulations for large quantities of radioactive materials is expected to reduce to an almost negligible level the probability of a large accident in the transportation system. Since the detection of radioactivity requires trained and equipped personnel, it is usually impossible to determine immediately the size of an accident. Furthermore, it is not at all clear that the handling of a large accident is qualitatively different from that of a small one; the procedures involved will be the same, though on a larger scale. For these reasons the following account is independent of the size of the accident and the type of radioactive waste involved.

The DOT regulations stipulate that the carrier must notify DOT by telephone at the earliest occurrence of fire, breakage, spillage, or suspected radioactive contamination involving shipment of radioactive material. This report must include specific information which will permit an effective emergency response. In addition, the shipper must be notified as quickly as possible. The regulations also recommend that the carrier contact the AEC for radiological advice or assistance, and that he follow the recommended practices of the Bureau of Explosives.[A-79]

The various Federal agencies concerned with radioactive materials (AEC, Department of Defense [DOD], Public Health Service, Department of Transportation) have developed the Interagency Radiological Assistance Plan (IRAP) for coping with accidents involving radioactive materials.[A-80] Both the AEC and DOD have well developed plans and trained emergency teams available at various locations throughout the United States. Other Federal agencies that may be contacted include the Office of Civil Defense, Public Health Service, and the Food and Drug Administration. A number of States have organized radiological emergency monitoring teams which can be dispatched to the scene of an accident, a practice that would be highly desirable for every State.

The handling of transportation accidents involving radioactive waste materials divides naturally into two parts, the emergency phase and the cleanup phase. In the emergency phase the major concerns are personnel safety, control of exposure, and containment of contamination. Hopefully, transportation personnel or knowledgeable bystanders will initiate proper emergency procedures immediately. However, in unfortunate cases, such as serious highway accidents, local police or firefighters may be the first to recognize the potential radioactivity hazard.

In any case, once the hazard is recognized it is important that the following procedures be carried out:

1. keep everyone except rescuers and other authorized persons from the accident scene;
2. notify AEC and local police and fire departments;
3. stay out of smoke or vapors;
4. try to hold for radiological monitoring anyone who may have been exposed;
5. leave firefighting to experts; and
6. do not permit taking of souvenirs.[A-80]

After the public safety personnel arrive in force, it should be possible to maintain these procedures until the radiological assistance team arrives. This team will monitor potentially contaminated people, initiate personnel decontamination, and monitor the accident area to determine the extent of contamination of the vehicle and its surroundings. Their findings will make it possible to establish a realistic perimeter around a restricted zone for subsequent cleanup activity.

The major concerns of the cleanup phase are decontamination and restoration of the vehicle and surroundings to normal service as safely and economically as possible. Fortunately, a book summarizing the results of worldwide research and operational experience with decontamination has been recently published.[A-81] Despite the fact that it is generally easier to remove fresh contamination, experience has shown that it is not wise to begin decontamination operations until careful planning has taken place. It is especially important to avoid the inadvertent spread of contamination and costly delays that can arise from a variety of deficiencies. It is imperative that the operation be controlled by one person, preferably a decontamination specialist. The complex selection of personnel, procedures, techniques, equipment, and supplies may depend on the details of the particular accident.

METHODS FOR DECONTAMINATION OF VEHICLES OR TRANSPORT SYSTEMS FOR RADIOACTIVE WASTES

The conventional procedures for decontaminating transportable equipment, such as vehicles or packaging, depend on contact with a chemical agent (soaking or spraying) or mechanical action (vacuum cleaning, high-pressure steam or water, or abrasive techniques).[A-81] Since these methods may produce a substantial volume of radioactive waste it is preferable to perform the cleaning in a decontamination facility such as a nuclear plant or waste disposal site where handling of such wastes is a routine matter. In order to transport the contaminated equipment safely it is necessary to pack or wrap it or otherwise immobilize the contamination. If field decontamination is required, methods that minimize the volume of radioactive waste are desirable.

Since transportation accidents generally occur out of doors some decontamination has to be done under field conditions, and techniques for decontaminating roadways, vehicles, building exteriors and land have been developed.[A-81] Unfortunately, many of these involve sweeping, flushing, or otherwise displacing the material without actually collecting it. Among the few collection methods are vacuum cleaning, vacuum sandblasting or grinding of hard surfaces, grinding or planing of wood surfaces, and scraping and removal of soil. Flame decontamination, which uses special equipment incorporating a burner, brush, and vacuum pickup, has been successfully done on concrete, wood, and asphalt; it is reported to be an effective method for small areas of wood and asphalt.[A-81] In many cases, it will be most economical simply to remove and replace the contaminated surface component. It should be noted that extensive development has been done on methods for decontaminating under cold weather conditions.[A-81] In addition, several pieces of highly specialized equipment have been developed which might be particularly useful in a large accident, including:

- a remotely controlled portable manipulator system;
- a power-driven, truck-carried spray decontaminating apparatus;
- a multiple-trailer mobile command post and clothing change facility; and
- aerial monitoring equipment in light aircraft or helicopters.

Since transportation accidents may also occur in facilities such as freight terminals, it is necessary to consider the decontamination of building interiors and exteriors. A variety of methods have been used successfully for this purpose, including:

1. washing with detergent and water or steam;
2. swabbing with water or decontaminating agents;
3. blasting with wet abrasives; and
4. vacuum blasting with dry abrasives.[A-91]

Steam cleaning and swabbing have the advantage of producing relatively small amounts of waste. However, for porous surfaces such as wood and concrete it is frequently necessary to resort to mechanical removal of an appreciable layer of surface material. Specialized machines for swabbing and blasting are available commercially.

APPENDIX S

UNIT OPERATIONS AND OPERATING COSTS FOR STORAGE OF HIGH-LEVEL RADIOACTIVE WASTES

UNIT OPERATIONS FOR STORAGE OF HIGH-LEVEL RADIOACTIVE WASTES-RECEIVING AND HANDLING

Procedures to be followed in the operation of the Retrievable Surface Storage Facility (RSSF) are dependent upon the design concept chosen. The following account is consistent with the preliminary design concept discussed in the main body of the report but will change as the design concept is changed.

High-level radioactive waste canisters will be received at the RSSF in shipping casks from the fuel reprocessing plants. These shipping casks provide shielding, cooling and impact protection for the canisters during transportation. The cask receiving area at the RSSF consists of a totally enclosed building with an air lock for contamination control into which a cask will be moved on either truck or railroad car. Inside this receiving area the cask and transporter are cleaned and surveyed for radioactive contamination.

The cleaned cask is removed from its transporter and cooled in the receiving area to minimize thermal shock to the cask and canister and to reduce the quantity of steam generated when the cask is submerged in the water in the unloading basin. The unloading basin is a large concrete vault filled with water to provide cooling and shielding. While under water, waste canisters are removed from their casks in the unloading basin which is equipped with an underwater window for visual inspection. After a canister has been determined acceptable for storage, it is moved from the unloading basin to the storage area by means of a movable hoist on rails.

The storage area consists of a number of modular basins where the wastes are stored under water for radioactive shipping purposes. The design concept for receiving and handling high-level waste canisters at the Retrievable Surface Storage Facility is illustrated in Figure A-24.[A-82] The flow diagram for unit operations of this receiving and handling facility is shown in Figure A-25.

FIGURE A-24

HOT CELL FACILITY IN RETRIEVABLE SURFACE STORAGE FACILITY FOR HIGH-LEVEL RADIOACTIVE WASTE

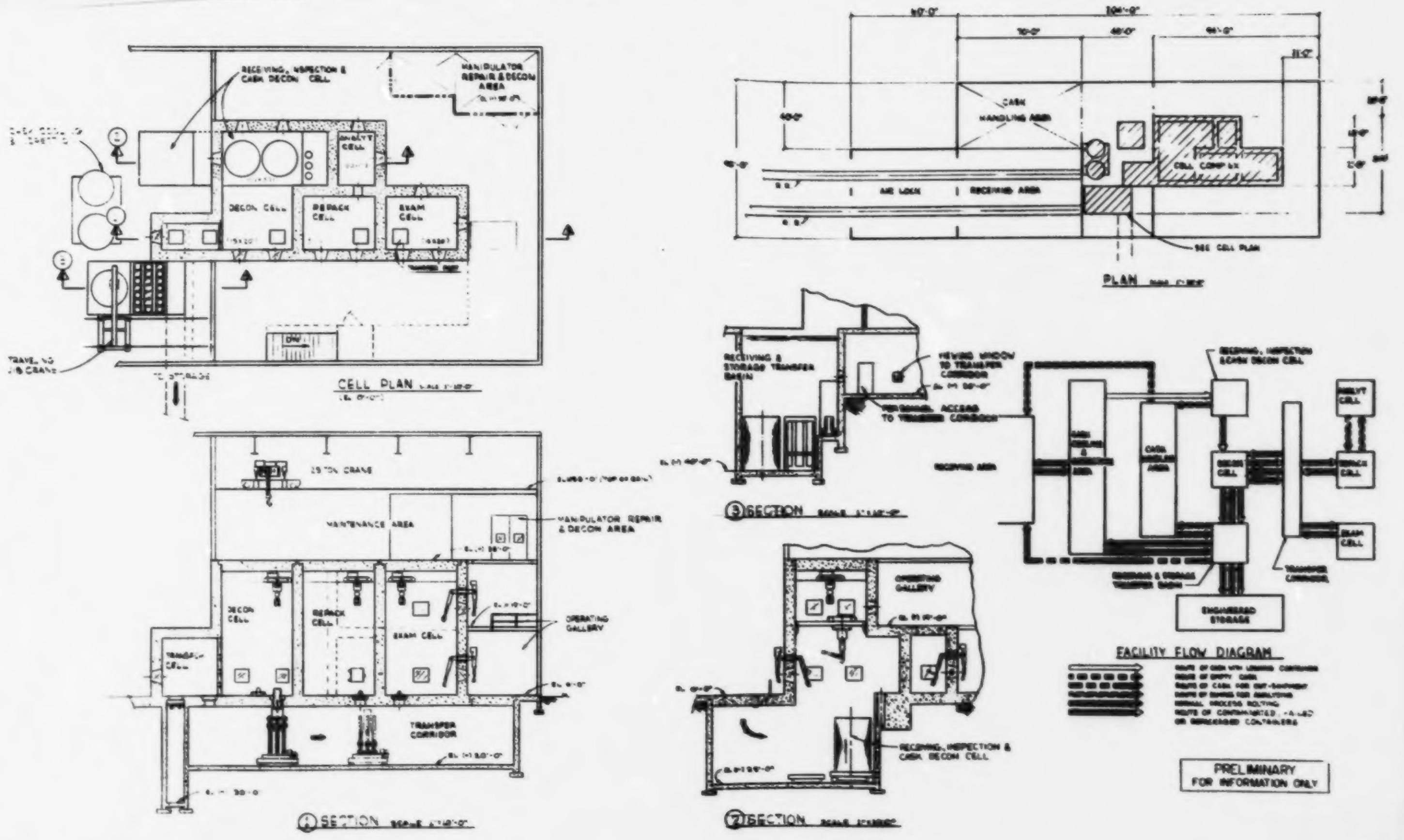
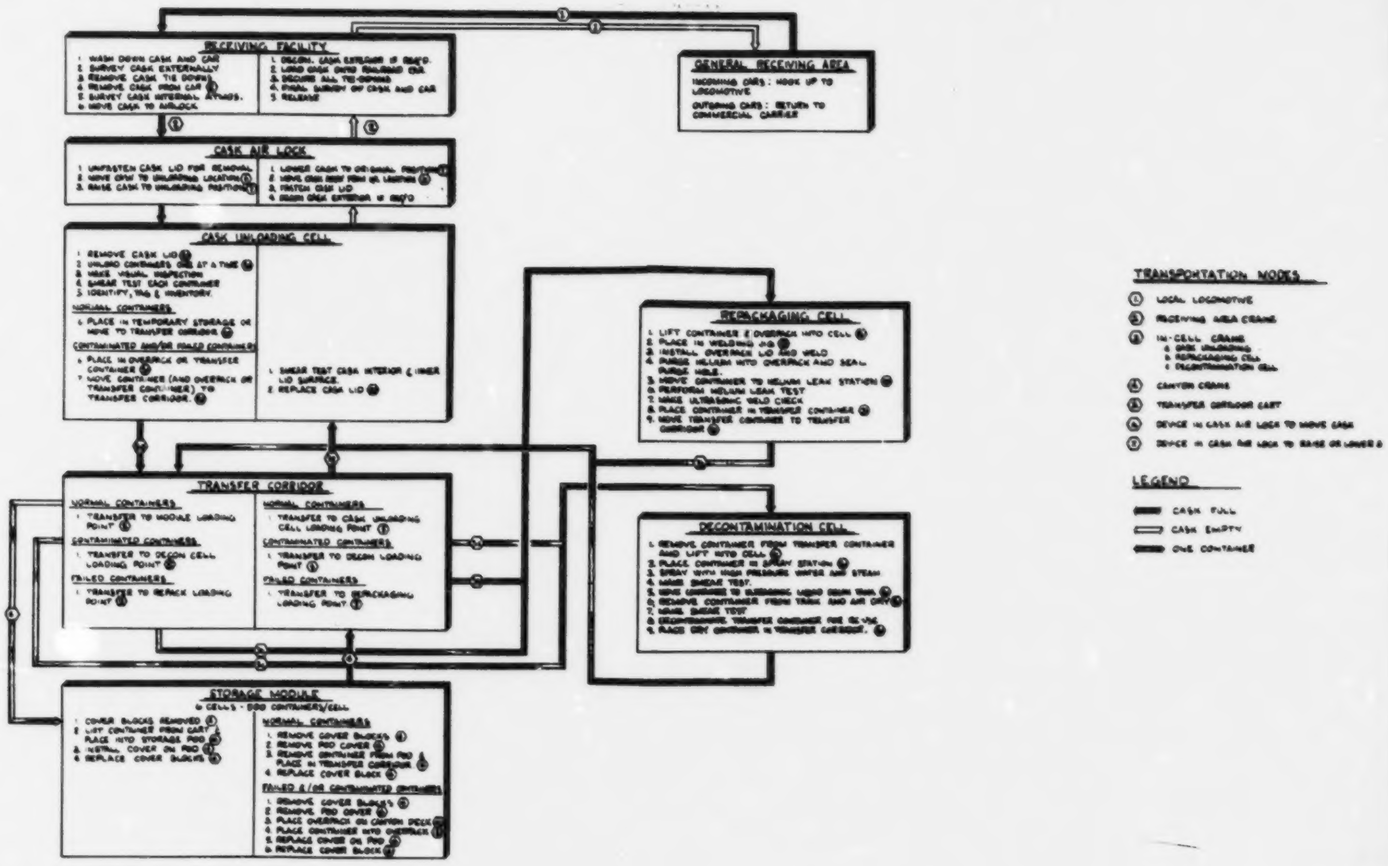

RECEIVING, INSPECTION & CASK DECON CELL
MANIPULATOR REPAIR & DECON AREA
ANALYT CELL
DECON CELL
REPACK CELL
EXAM CELL
TRAVELING JIB CRANE
TO STORAGE
CELL PLAN
25 TON CRANE
MAINTENANCE AREA
MANIPULATOR REPAIR & DECON AREA
DECON CELL
REPACK CELL
EXAM CELL
OPERATING GALLERY
TRANSFER CELL
TRANSFER CORRIDOR
① SECTION
CASK HANDLING AREA
AIR LOCK
RECEIVING AREA
CELL COMPLEX
SEE CELL PLAN
PLAN
RECEIVING & STORAGE TRANSFER BASIN
VIEWING WINDOW TO TRANSFER CORRIDOR
PERSONNEL ACCESS TO TRANSFER CORRIDOR
③ SECTION
OPERATING GALLERY
RECEIVING, INSPECTION & CASK DECON CELL
② SECTION
RECEIVING AREA
CASK HANDLING AREA
RECEIVING, INSPECTION & CASK DECON CELL
DECON CELL
ANALYT CELL
REPACK CELL
EXAM CELL
TRANSFER CORRIDOR
RECEIVING & STORAGE TRANSFER BASIN
ENGINEERED STORAGE
FACILITY FLOW DIAGRAM
ROUTE OF CASK WITH LOADED CONTAINER
ROUTE OF EMPTY CASK
ROUTE OF CASK FOR OUT-SHIPMENT
ROUTE OF SAMPLES FOR ANALYSIS
NORMAL PROCESS ROUTING
ROUTE OF CONTAMINATED, FAILED OR REPACKAGED CONTAINERS
PRELIMINARY FOR INFORMATION ONLY

FIGURE A-25

WASTE CANISTER HANDLING FLOW DIAGRAM FOR RETRIEVABLE SURFACE STORAGE FACILITY FOR HIGH-LEVEL RADIOACTIVE WASTES


RECEIVING FACILITY
1 WASH DOWN CASK AND CAR
2 SURVEY CASK EXTERNALLY
3 REMOVE CASK TIE DOWNS
4 REMOVE CASK FROM CAR
5 SURVEY CASK INTERNAL ATMOS.
6 MOVE CASK TO AIRLOCK
1 DECON. CASK EXTERIOR IF REQ'D.
2 LOAD CASK ONTO RAILROAD CAR
3 SECURE ALL TIE-DOWNS
4 FINAL SURVEY OF CASK AND CAR
5 RELEASE
GENERAL RECEIVING AREA
INCOMING CARS: HOOK UP TO LOCOMOTIVE
OUTGOING CARS: RETURN TO COMMERCIAL CARRIER
CASK AIR LOCK
1 UNFASTEN CASK LID FOR REMOVAL
2 MOVE CASK TO UNLOADING LOCATION
3 RAISE CASK TO UNLOADING POSITION
1 LOWER CASK TO ORIGINAL POSITION
2 MOVE CASK BACK FROM UL LOCATION
3 FASTEN CASK LID
4 DECON CASK EXTERIOR IF REQ'D
CASK UNLOADING CELL
1 REMOVE CASK LID
2 UNLOAD CONTAINERS ONE AT A TIME
3 MAKE VISUAL INSPECTION
4 SMEAR TEST EACH CONTAINER
5 IDENTIFY, TAG & INVENTORY
NORMAL CONTAINERS
6 PLACE IN TEMPORARY STORAGE OR MOVE TO TRANSFER CORRIDOR
CONTAMINATED AND/OR FAILED CONTAINERS
6 PLACE IN OVERPACK OR TRANSFER CONTAINER
7 MOVE CONTAINER (AND OVERPACK OR TRANSFER CONTAINER) TO TRANSFER CORRIDOR.
1 SMEAR TEST CASK INTERIOR & INNER LID SURFACE.
2 REPLACE CASK LID
REPACKAGING CELL
1 LIFT CONTAINER & OVERPACK INTO CELL
2 PLACE IN WELDING JIG
3 INSTALL OVERPACK LID AND WELD
4 PURGE HELIUM INTO OVERPACK AND SEAL PURGE HOLE.
5 MOVE CONTAINER TO HELIUM LEAK STATION
6 PERFORM HELIUM LEAK TEST
7 MAKE ULTRASONIC WELD CHECK
8 PLACE CONTAINER IN TRANSFER CONTAINER
9 MOVE TRANSFER CONTAINER TO TRANSFER CORRIDOR
TRANSFER CORRIDOR
NORMAL CONTAINERS
1 TRANSFER TO MODULE LOADING POINT
CONTAMINATED CONTAINERS
1 TRANSFER TO DECON CELL LOADING POINT
FAILED CONTAINERS
1 TRANSFER TO REPACK LOADING POINT
NORMAL CONTAINERS
1 TRANSFER TO CASK UNLOADING CELL LOADING POINT
CONTAMINATED CONTAINERS
1 TRANSFER TO DECON LOADING POINT
FAILED CONTAINERS
1 TRANSFER TO REPACKAGING LOADING POINT
DECONTAMINATION CELL
1 REMOVE CONTAINER FROM TRANSFER CONTAINER AND LIFT INTO CELL
2 PLACE CONTAINER IN SPRAY STATION
3 SPRAY WITH HIGH PRESSURE WATER AND STEAM
4 MAKE SMEAR TEST.
5 MOVE CONTAINER TO ULTRASONIC LIQUID DECON TANK
6 REMOVE CONTAINER FROM TANK AND AIR DRY
7 MAKE SMEAR TEST
8 DECONTAMINATE TRANSFER CONTAINER FOR RE-USE
9 PLACE DRY CONTAINER IN TRANSFER CORRIDOR.
STORAGE MODULE
6 CELLS - 800 CONTAINERS/CELL
1 COVER BLOCKS REMOVED
2 LIFT CONTAINER FROM CART & PLACE INTO STORAGE POD
3 INSTALL COVER ON POD
4 REPLACE COVER BLOCKS
NORMAL CONTAINERS
1 REMOVE COVER BLOCKS
2 REMOVE POD COVER
3 REMOVE CONTAINER FROM POD & PLACE IN TRANSFER CORRIDOR
4 REPLACE COVER BLOCK
FAILED &/OR CONTAMINATED CONTAINERS
1 REMOVE COVER BLOCKS
2 REMOVE POD COVER
3 PLACE OVERPACK ON CANYON DECK
4 PLACE CONTAINER INTO OVERPACK
5 REPLACE COVER ON POD
6 REPLACE COVER BLOCK
TRANSPORTATION MODES
LOCAL LOCOMOTIVE
RECEIVING AREA CRANE
IN-CELL CRANE
a CASK UNLOADING
b REPACKAGING CELL
c DECONTAMINATION CELL
CANYON CRANE
TRANSFER CORRIDOR CART
DEVICE IN CASK AIR LOCK TO MOVE CASK
DEVICE IN CASK AIR LOCK TO RAISE OR LOWER IT
LEGEND
CASK FULL
CASK EMPTY
ONE CONTAINER

Repackaging and Decontamination

When a canister is removed from its cask in the unloading basin and found to be contaminated it is moved to the transfer lock area of the basin, remotely raised out of the water and allowed to dry in the transfer cell (a concrete-shielded "hot cell" facility for remote operation). The dried canister is then placed in a transfer cask and moved into the transfer corridor leading to either the repackaging cell or to the canister decontamination cell.

The canister cladding is repaired by welding in the repackaging cell when the failure is minor. Complete removal of the waste from its failed canister and repackaging it, or placing the waste plus the failed canister into another container known as an overpack, is done when the original canister cannot be repaired acceptably. The repaired canister or the canister inside an overpack is then replaced in a transfer cask and moved through the transfer corridor to the decontamination cell. Both the waste canister and the transfer cask are sprayed with high pressure water and steam and decontaminated in an ultrasonic bath to remove any external radioactive contamination. After decontamination the transfer cask is moved to the transfer cell for reuse and the waste canister is moved through the unloading basin and transfer aisle into the storage area of the RSSF.

Operating Cost

Costs for operation of the Retrievable Surface Storage Facility for high-level radioactive wastes (in 1973 dollars) result primarily from operating manpower, utilities, material consumption, and equipment replacement. The operating cost is expected to increase as more waste storage capacity is used, so that the values developed here are nominal ones for a time about ten years after the facility begins operation. Some of these costs are highly unpredictable (such as the cost of recovery from an accident) while other costs, such as manpower, can be estimated more easily. Recognizing the uncertainties involved in many cost components, the total annual operating cost for the RSSF was estimated at about $3 million. Long-term amortization costs would add about 0.3 million per year. The components of cost considered in this estimate are given in Table A-97.[A-92]

The primary operations performed at the RSSF are waste receiving, waste storage, and associated waste handling functions. It is assumed that the facility is Federally owned and operated by a contractor, independent of other facilities that may exist in the same general area. Maintenance required for safe operation of the facility would be performed by the plant work force.

TABLE A-97

OVERALL OPERATING COSTS, RETRIEVABLE SURFACE STORAGE FACILITY FOR HIGH-LEVEL RADIOACTIVE WASTES

ITEM		ANNUAL COST, DOLLARS
Operating Manpower (minimum requirements)		$1.4 million
Miscellaneous Materials & Service (includes shared technical and administrative services)		$1.0 million
Accident and Incident Recovery		$0.1 million
Electricity and Water Consumption		$0.2 million
Container Repackaging		$0.1 million
Processing and Disposal of Wastes Generated		$0.2 million
	Total	$3.0 million

Operating cost savings may be realized if the facility is located at an existing plant site where many miscellaneous services such as occupational health care, fire protection, plant security, utilities, general maintenance, and procurement of spare parts, equipment and supplies could be obtained at increased efficiency since other similar facilities have similar requirements for these services.

Estimates of the minimum operating manpower were based on the requirements for surveillance, maintenance, operations (container handling and repackaging), and technical support of the high-level waste facility with six storage modules that will hold a total of 3,000 waste containers. This facility would be operated continuously with approximately ten people per eight-hour work shift. Although the detailed organization might vary from that shown for each shift in Figure A-26, it is believed that the total working crew requirements for all shifts would be about five times those shown. Four shifts are required for around-the-clock operation, and the fifth shift is always on the day shift. (It is typical for plants operating continuously to need an additional working crew approximately equivalent to a fifth shift which performs scheduled maintenance and special operations during the day-time shift and provides a work force reservoir for vacation and holiday relief.) The shift supervisor for each crew would report to the operations manager and be responsible for safe and efficient operation of the plant. If an adequate reservoir of technical and administrative support personnel were available on an existing plant site, manpower requirements for a minimum support capability for administration, planning, engineering, and safety at the facility would be reduced to those shown in Figure A-27. If the capability for administrative and technical support at the facility were required to be completely independent, the manpower requirements would be about twice those shown in Figure A-27.

Salaries and benefits were estimated at $15,000 annually per person. An equal amount was estimated to cover miscellaneous services, overhead, and an allowance for replacement of capital equipment. Indirect manpower requirements, such as security patrolmen, firemen, doctors, nurses, utility linemen, stores warehousemen, and truck drivers were included in miscellaneous services and overhead costs. The minimum direct manpower required for the high-level waste storage facility (the sum of those indicated in Figures A-26 and A-27) is expected to range from 70 to 90 people. A small number of the waste canisters may require repackaging upon receipt from the fuel reprocessing plants. An allowance for repackaging these and other containers which may fail during storage was included in the estimate.

FIGURE A-26

ORGANIZATION OF WORK CREW ON EACH SHIFT
FOR THE HIGH-LEVEL WASTE STORAGE FACILITY

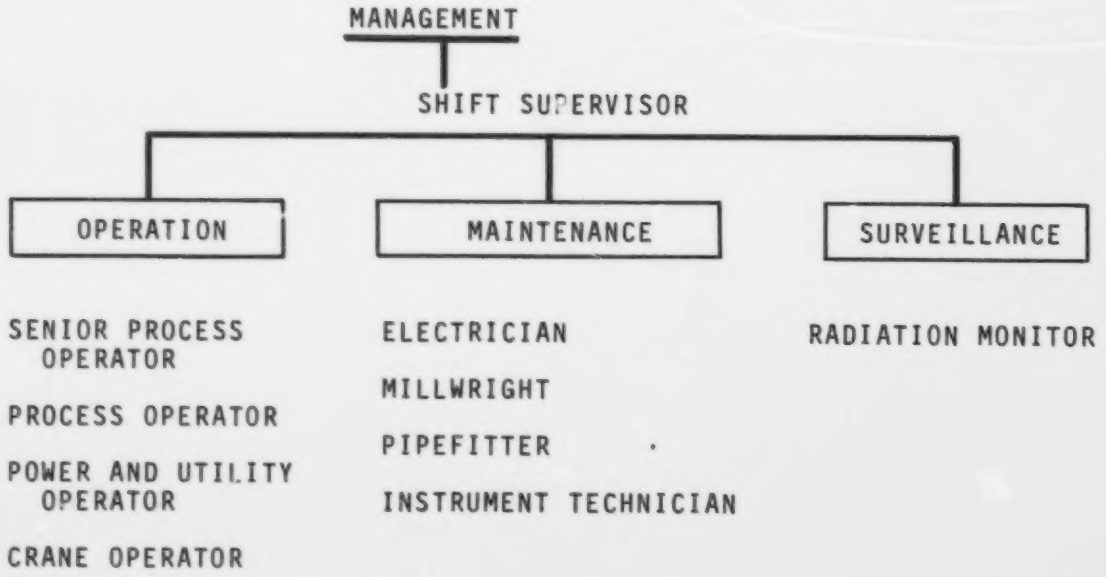
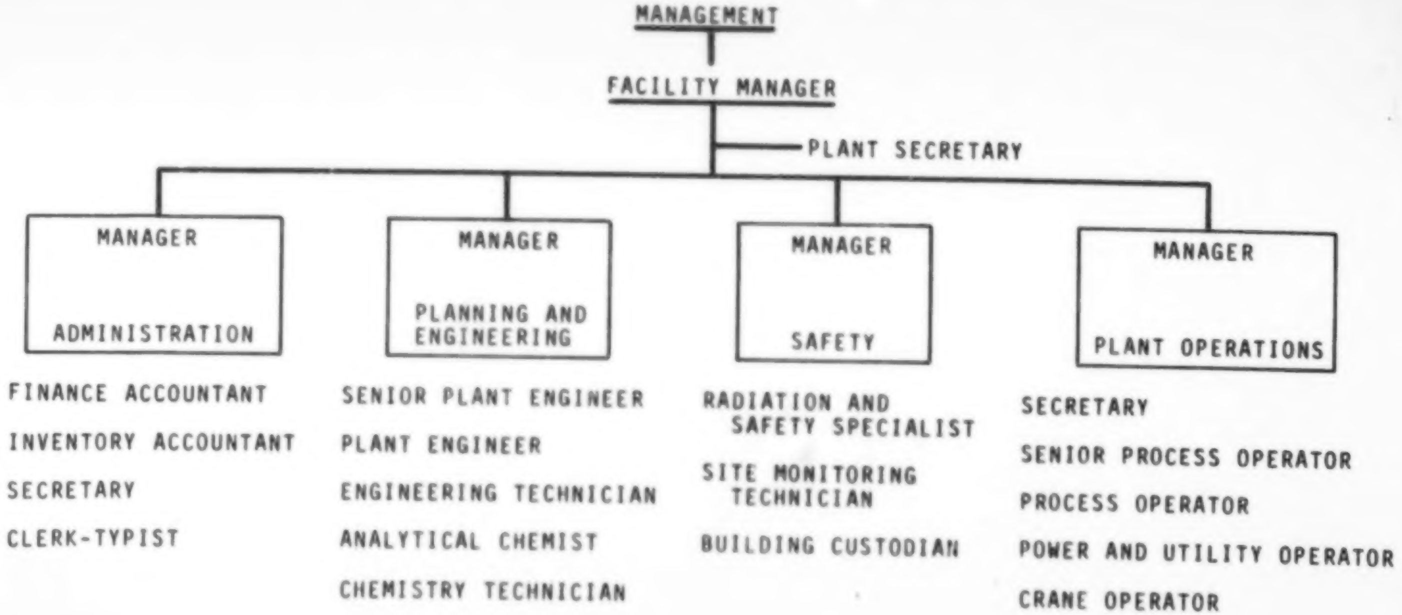

MANAGEMENT
SHIFT SUPERVISOR
OPERATION
MAINTENANCE
SURVEILLANCE
SENIOR PROCESS OPERATOR
PROCESS OPERATOR
POWER AND UTILITY OPERATOR
CRANE OPERATOR
ELECTRICIAN
MILLWRIGHT
PIPEFITTER
INSTRUMENT TECHNICIAN
RADIATION MONITOR

FIGURE A-27

MINIMUM ADMINISTRATIVE AND TECHNICAL SUPPORT MANPOWER REQUIREMENTS
FOR THE HIGH-LEVEL WASTE MANAGEMENT FACILITY
(ASSUMING SHARING OF PERSONNEL WITH OTHER ON-SITE FACILITIES)


MANAGEMENT
FACILITY MANAGER
PLANT SECRETARY
MANAGER
ADMINISTRATION
MANAGER
PLANNING AND ENGINEERING
MANAGER
SAFETY
MANAGER
PLANT OPERATIONS
FINANCE ACCOUNTANT
INVENTORY ACCOUNTANT
SECRETARY
CLERK-TYPIST
SENIOR PLANT ENGINEER
PLANT ENGINEER
ENGINEERING TECHNICIAN
ANALYTICAL CHEMIST
CHEMISTRY TECHNICIAN
RADIATION AND SAFETY SPECIALIST
SITE MONITORING TECHNICIAN
BUILDING CUSTODIAN
SECRETARY
SENIOR PROCESS OPERATOR
PROCESS OPERATOR
POWER AND UTILITY OPERATOR
CRANE OPERATOR

Consumption of electrical power contributes about seven percent of the total operating cost[A-83] due to a significant number of large water pumps in the high-level waste storage facility. The average rate of electrical consumption was estimated to be about two megawatts. The cost of electrical power in 1972 dollars was estimated at the rate of $0.01 per kilowatt hour.

Wastes generated in the RSSF will be primarily those associated with contaminated water and ventilation filtration. Ion exchange and filtration equipment will be used to remove radioactive contamination from the water in the facility. The liquid radioactive wastes will be concentrated by evaporation. The costs of the disposal for these wastes is a minor fraction of the operating cost, and a small allowance was made for it accordingly. The solid wastes (spent ion exchange resins and filters) will be packaged and transported to the national disposal site for low-level wastes.

APPENDIX T

UNIT OPERATIONS FOR STORAGE OF LOW-LEVEL RADIOACTIVE WASTES

Unit operations at the disposal site for low-level radioactive wastes will involve: 1) receiving, sorting, and handling; 2) decontamination of transportation devices, work areas, and equipment; 3) concentration, conversion to solid, and canning (e.g., incineration of solid wastes and evaporation of liquid wastes); and 4) storage for an extended period.

RECEIVING AND HANDLING

Low-level radioactive wastes will be hauled to the receiving facility by rail cars and trucks of various sizes. The receiving facility must be fully enclosed and sealed to insure that any spill of radioactive material during transfer operations from the common carrier to the facility is contained within the facility and does not enter the environment. The receiving area within the handling and transfer area should be designed for easy decontamination (e.g., with nonporous surfaces and a minimum of crevices and other obstructions). As with the rest of the treatment facility, ventilation air should flow from this area to the next higher potential area for contamination. All outside access to the receiving facility should be air-locked (separated from the outside by sealed doors) to prevent radioactive contamination from moving within or outside of the facility.

The facility must be capable of handling all shipping canisters approved by the Department of Transportation for both liquid and solid radioactive wastes. High capacity (50,000 pound) cranes and forklift trucks are required to handle the canisters. The facility must have handling and unloading provisions for low-level radioactive liquids shipped by truck or rail in drums and large tanks.

Facilities must be capable of removing wastes from bulk transfer canisters, decontaminating the canisters and returning them to the common carrier.

Normally, the key characteristics of the wastes (form, chemical content, physical properties, and radioactivity level) will have been previously defined for each waste shipment. However, occasional characterizations will be necessary at the disposal site to assure that the wastes are treated and stored with like materials.

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When a shipment of low-level radioactive wastes is received at the disposal site the records of its contents are checked, the external surfaces are checked for contamination, and the radiation levels are measured. The disposition of the wastes through the site is determined from this information.

All materials are handled within secondary enclosures such as hoods, glove boxes, plastic-covered pipes, or pseudo-hot cells. Materials with high radiation doses are handled semi-remotely behind concrete shielding using shielded viewing windows, manipulation, and cranes. Other materials are handled more directly without shielding or with portable shielding on the transport devices.

Transport of heavy packages or packages with high radiation dose rates is done by remotely-controlled cranes, including final placing in the storage warehouse. Other materials are handled by forklift trucks, by cranes, and by other conventional techniques.

The facility must have the capability of sorting the liquids and solids into combustible and noncombustible fractions and for storing each fraction for processing prior to disposal.

It is anticipated that the chemical composition of the liquid wastes will have been determined and certified before shipment to the disposal facility. To insure that noncompatible liquid wastes are not mixed together, the receiving facility has tankage for segregation of the liquid wastes until chemical analysis of each can be verified. Capabilities for sampling and chemical analysis are required at the disposal site to support this and the many other chemical operations which are used.

The solid wastes must be segregated or sorted manually into combustible and noncombustible fractions before processing. Limited automatic equipment is available for dry sorting of the various solid fractions. Most ferrous materials can be extracted from the solid waste stream by magnetic separation. Some success has been achieved with air classifiers in the separation of paper, plastics, and other combustibles from heavy materials such as glass, ceramics and metals. Due to the present state-of-the-art it is anticipated that the solid materials will be separated by hand in a glove box or shielded facility, depending on the radiation dose level.

DECONTAMINATION

Decontamination is discussed in detail in Appendix Q. Decontamination at a processing and storage facility utilizes essentially the same techniques, the major difference being that any contamination or spills will be kept within the facility and will be prevented from spreading beyond the facility by the building ventilation system which is complemented by administrative controls.

The receiving areas for the trucks and rail cars have provisions for cleaning modest amounts of external contamination by spraying with steam or water. These reusable equipment pieces must be decontaminated to nonsmearable levels. Packages of radioactive wastes with large amounts of external contamination are taken into a decontamination "hot cell" where external contamination is removed remotely. In more severe cases the packages are enclosed in a temporary secondary wrapping (such as plastic) and taken to an adjacent "hot cell" facility where the entire original package is put into a permanent second steel container and sealed. This package is then taken to the storage warehouse via the conventional handling techniques for waste packages. Highly contaminated waste packages with similar external radioactive contamination levels are handled in the same way but the work is done principally by manual control through thin walls of hoods or glove boxes.

Decontamination of work areas is handled as described in Appendix Q, using combinations of chemicals (steam, detergents, acids, bases, oxidants, etc.), elevated temperatures, and mechanical assistance (scrubbing, pressure blasting with liquids or solids such as ice or sand, or ultrasonic agitation for parts which can be removed and placed in ultrasonic baths). In some cases materials are physically removed (such as concrete, paint, etc.) or covered with shielding (such as paint, concrete, or metal). A frequently used, convenient technique for clean-up of contaminated areas is to coat all surfaces with a plastic film which can then be stripped away after a contamination spill. Techniques for decontamination have been studied extensively and are summarized in the literature.[A-84–A-86]

Equipment decontamination is done similarly. Small equipment may be soaked in baths of decontaminating solutions. Large equipment is usually decontaminated internally in place as fully as possible, then externally cleaned by manual techniques. If the equipment is to be discarded it may be cut into smaller pieces and packaged for storage in a storage warehouse.

Special care must be taken in the selection of chemicals and materials for use in decontamination operations. These materials eventually become wastes and must be processed within the facility. Therefore, they must be compatible with the waste processing and storage system at the facility.

VOLUME REDUCTION, CONVERSION TO SOLID, AND CANNING

For aqueous liquid wastes the choice of volume reduction technique is dependent on the amount and nature of the solids content of the wastes and to some extent on the corrosiveness of the wastes. If trace ionic components are the only solids present, ion exchange is suitable; if trace nonionic components are also present, dewatering might be accomplished by a process such as reverse osmosis. If the solids content is high both of these methods fail and evaporation and precipitation become favored candidates. However, precipitation is chemically specific and many compounds are too soluble to be precipitated with common industrial chemicals.

For all aqueous systems, evaporation concentration is the only multipurpose method which will achieve volume reduction and conversion of liquids to a solid. The evaporator system must be corrosion resistant under a wide variety of conditions, there must be a sludge removal and drying system, the water vapor and the off-gas must be treated to remove radioactive entrainment and harmful volatile gases, the water vapor must be condensed, and the water must be retained until it is sampled to determine whether it can be released to the environment. (Alternatively, the water vapor could be released directly to the air). AEC sites such as Hanford and Savannah River have large evaporators for high-level wastes and separate evaporators for low-level wastes. Commercial fuel reprocessing plants also have evaporators for high-level wastes. In general, these plants attempt to recycle evaporated water and nitric acid for reuse rather than to dispose of it.

A wiped film evaporator was selected because this type can provide complete dryness to a powdered product and generally has low sensitivity to foaming materials. This type of evaporator uses mechanically rotated blades to keep the scale concentrate off the walls and to force the solid product through the discharge pipe. With proper but conventional designs entrainment of aerosols into the vapor stream from the evaporator amounts to less than one part in 100,000, so the vapor stream has low levels of radioactivity. The high efficiency glass fibered mist eliminator on the evaporator vapor stream further reduces entrainment and the final stage cleanup with a water scrubber removes vapors of volatile constituents.

The product from the evaporator, which can vary from a dry powder to a sludge with the consistency of tooth paste, is routed to a small dryer for final removal of water. This dryer is indirectly heated and mechanically agitated to force the dry powder out of the discharge end. The dryer vents to the same off-gas de-entraining and scrubbing system as the evaporator vapors.

The dried waste from the dryer is metered into the standard steel cans. The full cans are then welded shut, monitored, labeled, decontaminated if necessary, and sent to the storage area.

Volume reduction of solid wastes again depends on the form of the wastes. Mechanical compaction can usually achieve volume reductions of ten to one.$^{A-87}$ However, if combustible wastes are compacted a danger of fire hazard is always present in the stored wastes. In this design concept all combustible wastes are incinerated before storage and incineration causes significant volume reductions without compaction. Thus, compaction was not selected for use in the disposal site.

Chemical leaching (such as acid digestion) of solid wastes can convert the combustible materials to their combustion products in an aqueous system and achieve volume reductions of fifty to one.$^{A-88}$ The potential advantages of the acid digestion process are a possible reduction in the off-gas treatment problem, a relatively low temperature process (250 to 270°C) that is easier to control than combustion, and very little need for sorting before its application. On the other hand, the resulting liquid sludge must be treated for removal of radioactivity and recycle and the solid residue must be dewatered. Due to the cost of the undeveloped state-of-the-art of acid digestion of combustible solid wastes this process was not selected for use here, but it could have potential for future use.

Pyrolysis^{A-89} is essentially incineration at low temperatures (up to about 800°C) under less oxidizing conditions, with the potential production of useful, combustible off-gases. Pyrolysis was considered for combustion of radioactive wastes because of its low off-gas volume, its relatively low temperature, and the good characteristics of its residue. However, it has not yet been extensively investigated for radioactive wastes and its state of development is similar to that of acid digestion for the application here. Therefore, it was not selected for use in this instance but it could have future application.

Incineration^{A-86} is currently used for some wastes at several AEC facilities and is the method selected for the disposal site. Of the many types of commercial incinerators only the rotary kiln and the ordinary fire-box incinerator, which was selected for use here, appear to be readily adaptable to burning radioactive wastes. The ordinary incinerator has the disadvantage of incomplete combustion due to liquefying plastics dropping through the grate into the ash box, but this is usually more than offset by the high maintenance costs of rotary kilns. For radioactive wastes, off-gas cleaning is a significant problem because the off-gas equipment must be remotely operable, designed geometrically to be critically safe at all times, and able to remove submicron-size dust and corrosive and contaminated gases. Thus the large volume of off-gas must be treated to achieve radioactive decontamination factors of up to 10^7 for fly ash. A low efficiency-high capacity filter system, a wet-scrubbing system, and a high-efficiency filter make the off-gas treatment auxiliaries the most expensive part of the incinerator system.

Combustible organic liquids such as tributylphosphate and di-2 ethylhexyl phosphoric acid in kerosene must be incinerated because of their unreleasable chemical compositions. They often present special problems in an incinerator designed only for solids because of the unusual combustion products which sometimes include high concentrations of aerosols. In this conceptual design for the disposal site combustible liquids will be fed to the same incinerator simultaneously with the combustible solids.

The ashes from the remotely operated incinerator will be conveyed to the incinerator loading station. Here the ashes will be metered into standard steel cans. The cans are welded shut, monitored, labeled, decontaminated if necessary, and sent to the storage area.

Alternative methods for solidification or immobilization of radioactive wastes without volume reduction, such as mixing with concrete or asphalt, are being used in Europe.[A-89] These techniques were not selected here because of the lack of volume reduction; in fact, a significant increase in waste volume generally results from the use of such procedures.

STORAGE OF LOW-LEVEL RADIOACTIVE WASTES

The encapsulated and solidified low-level radioactive wastes will be stored as previously described in two types of warehouses. One type will include up to three feet of concrete shielding (including removable cover blocks) to allow for storage of wastes with high radiation dose rates; the other will have essentially no shielding for wastes with very low radiation dose rates. The wastes in either case will be stored in rectangular, sealed steel canisters 4 feet by 6 feet by 6 feet high arranged in three layers.

Transfer of wastes to the shielded warehouses is done semiremotely by crane whereas transfer to the unshielded warehouses is done directly by forklift truck. Ventilation requirements for the warehouses were described previously under the storage concept.

The wastes will remain in the warehouses untouched unless they must be removed for recanning due to leakage or until they are to be transferred to other disposal facilities. Routine visual inspection will be made of each canister and continual monitoring of the exhaust ventilation air from each of the compartments in the warehouses will be maintained.

APPENDIX U

COST ESTIMATES FOR LOW-LEVEL WASTE DISPOSAL SITE

The capital and operating costs for facilities with incineration capacities of up to 500 pounds per hour have been estimated, but no data on actual operating or capital costs for facilities of the size required to meet the total production rate in 1980 were available.[A-90] Therefore, a capital and operating cost estimate was made for a facility with the capability of concentrating an average of 3500 gallons of liquid radioactive waste and incinerating an average of 1400 pounds of solid radioactive waste per hour (these are average hourly production values comparable to the annual rates previously described). The capital and operating costs of remote radioactive processing facilities are highly dependent on the design criteria and operational procedures established for the facility. These are high-spot estimates.

CAPITAL COSTS

The estimated capital cost for the processing facility is rounded to $19,000,000 as shown in Table A-98. The high-spot capital cost for the storage facility is $23,600,000 as shown in Table A-99.

The storage warehouse will occupy a space of about five acres. The processing facility will be smaller, about 0.5 acres. To provide added protection for the public, a controlled plant area will be needed around the plant and warehouse. A 0.5-mile exclusion distance should be adequate for low-level wastes. Assuming the cost of land is $1,000 per acre, the acquisition of land is about $800,000. Access roads on the plant site for both truck and rail car add another $2,000,000 to the total capital cost.

Costs were established on the basis of buildings able to withstand tornadoes and earthquakes, with use of the present state-of-the-art practice for contamination control, shielding, and remote handling. Storage capital is also dependent on the height to which the canisters are stacked. The standard 4 feet by 6 feet by 6 feet high canisters can be stored from one to five high and satisfy technical requirements for storage. If containers are stacked three high, the capital cost for a storage facility is $8.19 per cubic foot of material stored.

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TABLE A-98

CAPITAL COSTS FOR LOW-LEVEL WASTE PROCESSING FACILITY

Item	Estimated Cost
Head-End Material Handling (Includes: solid and liquid receiving; storage for 1 week's production, decontamination system, segregation and fuel preparation systems, instrumentation, 60 feet x 200 feet section of building with some shielded areas)	$4,100,000
Incineration Area (Includes: incinerator, gas cleaning equipment, vent system, 35 feet x 60 feet section of building with some shielded areas)	1,900,000
Evaporation Area (Includes: evaporator, dryer, condenser, retention pond, instrumentation, 25 feet x 60 feet section of building with some shielded areas)	1,600,000
Waste Packaging Area (Includes: compaction, handling, decontamination equipment, and 30 feet x 60 feet section of building)	640,000
Auxiliaries (Includes: utility supply and auxiliary equipment, site preparation, paving and landscaping)	900,000
Total Direct and Indirect Capital Cost	9,140,000
Facility Design, Engineering, Quality Assurance Fee and Contingencies (75% of Direct and Indirect Capital Cost)	6,860,000
Land Acquisition Cost	800,000
Access Roads for Truck and Rail	2,000,000
Total Capital Cost for Processing Facility	$18,800,000

Bases: Capacity is 3500 gallons of liquid waste per hour and 1400 lbs. of solid waste per hour, both of which are average at 80% operating efficiency.

TABLE A-99

CAPITAL COSTS FOR FACILITY FOR STORAGE OF LOW-LEVEL RADIOACTIVE WASTES

Item	Estimated Cost
2 Shielded Buildings, 100,000 Square Feet at $100 per Square Foot	$10,000,000
3 Unshielded Buildings, 150,000 Square Feet at $50 per Cubic Foot	7,500,000
Total Direct and Indirect Capital Cost	17,500,000
Facility Design, Engineering, Quality Assurance Fee and Contingencies (35% of Direct and Indirect Capital Cost)	6,100,000
Total Storage Facility Cost	23,600,000
Capital Cost per Cubic Foot of Storage Space	8.19 per cubic foot
Total Capital Cost for Storage Space for 4850 Canisters (1980 Production rate)	5,700,000
Total Complex Capital Cost (Processing and Storage Facility)	$42,400,000

Bases: Containers are 4 feet by 6 feet by 6 feet, stacked three high. The $23,600,000 facility is capable of housing 20,000 canisters. Maximum production rate in 1980 will be 4850 canisters per year.

OPERATING COSTS

Operating costs were developed using the capital costs as the primary basis. Other assumptions used in the development of the operating costs were:

- continuous processing at 80 percent efficiency on a seven-day-per-week, 24-hour-per-day basis;
- equal distribution of unit costs between liquid wastes and solid wastes on the basis of the amount of solids generated;
- capacity of the plant estimated to be 2.5×10^6 cubic feet solid waste and 30×10^6 gallons of liquid waste per year; and
- minimum operating crew.

Total operating costs were estimated to be $10.00 per cubic foot of solids stored or $1.00 per cubic foot of solid waste as received and $0.11 per gallon of liquid as received, as shown in Table A-100 Storage operating costs for the year 1980 were estimated to be $2.40 per cubic foot per year, as shown in Table A-101 The operating costs are dependent primarily on capital costs and operating efficiency. It is felt that the capital and operating costs are good high-spot costs for the capacities and assumptions used. This study shows that processing will be the major cost item and storage the minor cost item per year, but the storage costs are accumulative over a period of years.

In view of the extremely high total costs, a detailed cost/benefit study (which is beyond the scope of this inquiry) on alternative concepts and needs for storage/disposal of low-level radioactive wastes is certainly warranted.

DESIGN AND CONSTRUCTION SCHEDULE

The major elements involved in implementing a radioactive processing and storage facility include: overall hazard and concept analysis, design, construction, acceptance testing, and environmental impact and licensing activities. The length of time required for impact statement and licensing activities is difficult to estimate, as no precedent has been set. If the disposal site is built and operated by a firm with experience in the handling and disposal of radioactive wastes, safety analysis and environmental impact activity can probably be completed in two to three years. Assuming that detail is not started until all licensing and environmental impact work is completed, an additional three and one-half years would be required before the

TABLE A-100

OPERATING COST FOR PROCESSING LIQUID AND SOLID LOW-LEVEL RADIOACTIVE WASTES

Item	Cost, Dollars
Amortization and Interest at 6 Percent, 15 Year Plant Life	1,900,000
Maintenance at 5 Percent of Capital Cost	940,000
Taxes and Insurance at 3 Percent of Facility Cost	560,000
Direct Operating Labor and Supervision	520,000
Overhead at 120 Percent of Direct Labor	620,000
Supplies and Services at 20 Percent of Maintenance	190,000
Storage Canisters 4850 at $50 Per Canister	240,000
Steam and Powers and Utilities	600,000
Total Annual Operating Cost	5,570,000

Operating Cost Per Cubic Feet of Stored Solids	10.00 per cubic feet
Operating Cost Per Cubic Feet of Received Solids	1.00 per cubic feet
Operating Cost Per Cubic Feet of Received Liquid	1.06 per cubic feet
Operating Cost Per Gallon of Received Liquid	0.14 per gallon

Bases: 24 hour per day operation, 365 days per year operation, 2.5×10^6 cubic feet of solid waste processed per year, 30×10^6 gallon liquid waste processed per year, 80 percent operating efficiency.

TABLE A-101

ANNUAL STORAGE COST FOR STORAGE OF LOW-LEVEL RADIOACTIVE WASTE, ONE YEARS PRODUCTION-1980

Item	Estimated Cost, Dollars
Amortization and Interest at 6 Percent, 50 Year Plant Life	340,000
Maintenance at 2.5 Per Cent of Capital Cost	140,000
Taxes and Insurance at 3 Percent of Capital Cost	165,000
Direct Operating Labor and Supervision	300,000
Overhead at 120 Percent of Direct Labor	360,000
Supplies and Services at 15 Percent Maintenance	27,000
Total Annual Storage Cost	1,332,000
Storage Cost Per Cubic Feet Stored Solids	2.40 Per Cubic Feet Per Year

Bases: Life of storage facility is 50 years. Storage facility is built as required. Based on annual processing rate of 2.5 x 10^6 cubic feet of solid waste per year and 30 x 10^6 gallons of liquid waste per year. Solid waste is stored in 4 foot x 6 foot x 6 foot high canisters stacked 3 high. Total quantity of solid waste stored per year is 7 x 10^5 cubic feet.

plant could be operable at full capacity. Thus, the total time requirement would be about six years. If the environmental impact and licensing work can be conducted in parallel with some design and construction, the facility might be fully operational in a minimum of approximately five years.

APPENDIX V

FINANCING CONSIDERATIONS

PUBLIC SECTOR FINANCE

This section provides a survey of the present and potential mechanisms for State and local financing of solid and hazardous waste disposal facilities. It includes a discussion of general categories of financing mechanisms and their relative merits and a tabular presentation of specific examples of State and local solid and/or hazardous waste disposal facilities. A discussion of the most viable alternatives will be developed later based on the information presented here.

State and Local Agencies

Historically, the burden of solid waste disposal has been the responsibility of local governments or private firms. Systematic hazardous waste disposal has been handled both by private firms and by public organizations. The increasing magnitude and complexity of local waste disposal, combined with the difficulty of financing sophisticated, large-scale facilities, have prompted investigation of a means of obtaining additional financial resources. Present sources vary from area to area but include direct financing from various tax sources, general obligation bonds, and revenue bonds. Financing by local authorities or State utilities is a potential technique and in several cases has been tried. Each of these mechanisms is discussed below. Examples will be found in Table A-102

Not all existing mechanisms for solid waste disposal will be relevant to the complexities inherent in disposal of hazardous wastes. Presentation of characteristics of existing mechanisms is important, however, for assessing actual cases and for evaluating the potentials of proposed financing mechanisms.

Direct Revenue Financing

Income taxes, property taxes, and various types of special-use taxes are potential sources of direct municipal revenue. Use of these sources to finance new facilities requires an initial budget surplus or payment of costs as they are incurred. The advantages are the flexibility and low cost associated with use of such funds. These sources are likely to be more reliable than other forms of local finance, since voter approval is generally not required. On the other hand, financing of

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TABLE A-102

FINANCING MECHANISMS

OWNERSHIP OR MANAGEMENT, NAME, LOCATION	WASTE CLASS	FINANCIAL REQUIREMENTS		SOURCES OF FUNDS		CONDITIONS ON SOURCES OF FUNDS	COMMENTS/ REFERENCES
		CAPITAL	OPERATING	CAPITAL	OPERATING		
LOCAL MONTGOMERY COUNTY, OHIO 2,600 - TON CAPACITY INCINERATORS	COUNTY GARBAGE AND REFUSE DISPOSAL	$11.3 MILLION--$8.[illegible] MILLION FOR CONSTRUCTION, $560,000 FOR LAND, $576,000 FOR ENGINEERING, $725,000 FOR CAPITALIZED INTEREST, $500,000 FOR CAPITALIZED BOND FUND, $138,000 FOR LEGAL, FISCAL, ETC. SERVICES, $240,000 TO DISCOUNT THE BONDS.		$3.3 MILLION GO BONDS. $8.0 MILLION REVENUE BONDS. PAID FOR BY USER CHARGES.	USER CHARGES	INCREASE IN RATES SUBJECT TO APPROVAL BY THE ADVISORY BOARD TO THE BOARD OF COUNTY COMMISSIONERS.	REFERENCE A-94
LOCAL TACOMA, WASHINGTON (CITY SOLID WASTE DISPOSAL UTILITY 26 TRUCKS, LANDFILL AND EQUIPMENT)	SOLID WASTE MUNICIPAL REFUSE	ASSETS (1969 - $929,618).	OPERATING EXPENSE (1969 - $1,141,957)	PAY-AS-YOU-GO. GENERAL REVENUES.	USER CHARGES (INCOME FROM RESIDENTIAL SERVICE, COMMERCIAL SERVICE, SERVICE WITH SPECIAL RATES, WASTE PAPER SALES, DUMP CHARGES, SALVAGE RIGHTS AND MISCELLANEOUS OPERATING INCOME).	MUST REQUEST RATE INCREASE FROM THE CITY COUNCIL.	REFERENCE A-92
LOCAL COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY, CALIFORNIA VARIOUS LANDFILL SITES WITHIN THE COUNTY	COUNTY GARBAGE AND REFUSE DISPOSAL	NOT AVAILABLE	NOT AVAILABLE	SPECIAL AD VALOREM TAX ON PROPERTY AND GENERAL COUNTY FUNDS REPAID BY USER FEES (AT NO INTEREST).	DISPOSAL FEES.	TRUST FUND SET UP BETWEEN THE COUNTY AND THE DISTRICTS--RECEIVES ALL SURPLUS REVENUE. CAN ONLY BE USED FOR ACQUISITION OF SOLID WASTE DISPOSAL FACILITIES AND LANDSCAPING LANDFILLS THAT ARE COMPLETED.	REFERENCE A-94

TABLE A-102 (continued)

OWNERSHIP OR MANAGEMENT, NAME, LOCATION	WASTE CALSS	FINANCIAL REQUIREMENTS		SOURCES OF FUNDS		CONDITIONS ON SOURCES OF FUNDS	COMMENTS/REFERENCES
		CAPITAL	OPERATING	CAPITAL	OPERATING		
STATE ENVIRONMENTAL FACILITIES CORPORATION NEW YORK	LIQUID AND SOLID WASTE TREATMENT.	NOT AVAILABLE EFC HAS NOT YET IMPLEMENTED ANY FACILITIES; HAS PROVIDED MONEY TO STATE'S MUNICIPALITIES FOR CONSTRUCTION, THROUGH SHORT-TERM NOTES. CURRENTLY INVESTIGATING THE FEASIBILITY OF ESTABLISHING ENVIRONMENTAL PARKS (LARGE REGIONAL SANITARY LANDFILLS SURROUNDED BY RECYCLING INDUSTRIES).		REVENUE BONDS	USER FEES AND REVENUES FROM RECYCLED MATERIALS	NOT APPLICABLE EFC SERVICES ARE NOT AVAILABLE ON AN INDIVIDUAL CONTRACT BASIS.	PROVIDES SERVICES THROUGH MUNICIPALITIES: CANNOT DEAL DIRECTLY WITH FIRMS. MANY SMALL COMMUNITIES FINDING IT TO THEIR ADVANTAGE TO CONTRACT WITH EFC FOR COMPLETE WASTE DISPOSAL SERVICES. REFERENCE A-91
STATE MARYLAND ENVIRONMENTAL SERVICE HOUSED WITHIN THE DEPARTMENT OF NATURAL RESOURCES	LIQUID AND SOLID WASTES.	HAS NOT YET IMPLEMENTED ANY MAJOR PROGRAMS. WILL PRESUMABLE FINANCE AND OPERATE A WIDE VARIETY OF FACILITY SIZES.		STATE REPAYMENT AND REVENUE BONDS WITH USER FEES TO REPAY BOTH. STATE'S GENERAL OBLIGATION BONDS.	USER FEES	BONDS ARE TAX EXEMPT MES INDEBTEDNESS DOES NOT ACCRUE TO LOCAL OR STATE INDEBTEDNESS. SERVICE CHARGES AND CONSTRUCTION COSTS BECOME A LIEN AGAINST INDUSTRIAL OR MUNICIPAL PROPERTY IN ADVENT OF FAILURE TO PAY.	WORKS IN COOPERATION WITH LOCAL UNITS OF GOVERNMENT AND INDUSTRY. IT HAS THE AUTHORITY, WHEN DIRECTED BY SEC. OF NATURAL RESOURCES, TO TAKE OVER INDUSTRY OR LOCAL WASTE TREATMENT OPERATIONS. MARYLAND COMPTROLLER CAN DIVERT 5 TYPES OF STATE-SHARED REVENUES UP TO THE AMOUNT LOCAL GOVERNMENTS HAVE CONTRACTED TO PAY MES IF LOCAL GOVERNMENT FAILS TO MEET CONDITIONS OF THE CONTRAC REFERENCE A-93
STATE OHIO WATER DEVELOPMENT AUTHORITY COLUMBUS, OHIO	LIQUID AND SOLID WASTE DISPOSAL SERVICES.	NOT APPLICABLE FINANCES A VARIETY OF FACILITIES.		ISSUES ITS OWN REVENUE BONDS, ADMINISTERS FUNDS UNDER SECTION 8 OF THE FEDERAL WATER POLLUTION CONTROL ACT.	USER CHARGES	OWDA PROPERTIES EXEMPTED FROM PROPERTY TAXES. MAY USE LEASE PURCHASE ARRANGEMENTS FOR INDUSTRIES.	EITHER RECIPIENT OF FUNDS OR OWDA MAY OPERATE THE FACILITIES. REFERENCE A-91
STATE PRIVATE/ OHIO OWDA MEADE CORP. CHILLICOTHE PAPER MILL	LIQUID, 10-ACRE AERATED LAGOON, SECONDARY TREATMENT.	$2 MILLION		REVENUE BONDS		10-YEAR LEASE	REFERENCE A-91
STATE/PRIVATE/ OHIO OWDA STONE CONTAINER CORPORATION COSHOCTON, OHIO	LIQUID: ACQUISITION AND CONSTRUCTION OF LAGOONS AND AERATORS FOR SECONDARY WASTE TREATMENT (55 ACRES).	$2 MILLION		REVENUE BONDS		10-YEAR LEASE	REFERENCE A-91

capital facilities from accumulated funds may not place a fair burden on future citizens of the community. In terms of the ability of the source to provide adequate funds for large-scale facilities, it does not seem particularly promising at the local level.

General Obligation Bonds

These bonds are backed by the full faith and credit of the issuing municipality or community. As such, they represent the most widely used debt instrument for financing State and local capital expenditures. Advantages of this source include the reduction of present financing requirements from general revenue and lower interest costs due to the lower investor risk and exemption from Federal income tax. In many cases, the information requirements for issuing general obligation bonds are already available from other general bond issues. This also helps to reduce financing costs. Disadvantages include the reduction of municipal debt capacity and reluctance of the electorate to increase its taxes to service the debt. Interest costs for small communities are generally higher than for larger ones.

Revenue Bonds

These bonds are secured completely by the charges of revenue of an income-earning facility or project. The revenue bonds do not generally require voter approval and may be issued by municipalities, counties, authorities, and commissions. Use of this source may result in several advantages. Most important, revenue bonds do not reduce the bond indebtedness limitations of local governments. A second advantage is the independence from voter rejection which can be achieved. The final advantage to this method is that only those who use the facilities are required to pay for them. Disadvantages often include higher interest costs, depending on the credit rating of the issuing municipality. Extensive reliance on debt financing will also reduce a municipality's credit quality. Use of revenue bonds may also involve overly restrictive agreements against diversion of revenues and mismanagement.

Special Assessment Bonds

This vehicle involves the levying of a specified rate and a flat sum charge for each type of property. The advantage is that those who benefit also pay for the services. Disadvantages are similar to those of the general obligation bond in that a local government's debt capacity is reduced. For the most part, this approach would be inapplicable for large-scale facilities.

Industrial Revenue Bonds

In all but a few States legislation formerly existed which permitted cities and counties to issue bonds for financing construction or acquisition of industrial facilities. A $5,000,000 ceiling on the bonds placed by Congress in 1968 caused the market to dry up. At the same time, Congress exempted bonds for pollution control facilities from the ceiling. Thus local communities can use pollution control bonds to finance industrial facilities. In this sense these vehicles are different from general obligation bonds in that the local government's debt capacity is not reduced. However, this debt may affect the credit rating of the community. Drawbacks include the effect on local government credit and its capacity to finance other capital expenditures.[A-92] The public subsidization of industrial abatement cost is another major issue in this approach.

Authority Financing

In many States it is possible under existing State corporation laws for local governments to create nonprofit corporations (authorities) which can issue revenue bonds. A deficit in the operations of the authority does not result in a lien against the local government. Also, the marketability of the revenue bonds is independent of the municipality's credit rating. If the authority fails, there is no credit effect on the municipality.[A-93] If the loan provides for purchase of the facility at the end of the period IRS treats it as an industry debt, resulting in a deduction for interest and depreciation. The alternative is to deduct payments as operating expenses. Since the term of membership of the governing board generally outlasts the administration of the local government, a degree of political independence is also achieved through this mechanism.

Loss of political control may be a disadvantage from the point of view of elected officials of local government. The New York Port Authority is one case in which an authority has gained significant independent powers. Some opinion holds that the Port Authority lacks the constraints to make it responsive to public wants.

Leasing

In some cases local governments can meet their needs for the financing of facilities through leasing from the private sector. The major advantage here is that no bond issues or accumulation of excess revenues are required. This method also provides a certain additional flexibility in planning, since no elections are required. The major disadvantage is the cost. Since the private sector must recover full costs plus profits, rental fees are generally greater than the interest cost that would be incurred through debt financing. In the State of Ohio leasing of facilities is being interpreted as the creation of debt, thus requiring all the constraints of a regular debt issue.

Lease/Purchase

The only difference between lease/purchase and direct leasing is that the ownership of the facility reverts to the municipality after the private investor has recovered his costs, interests, and profits, usually within a specified number of years. Advantages to this approach are the flexibility it provides as well as the creation of equity at the close of the lease period. Disadvantages include the higher costs.

It is possible is some States to arrange for lease/purchase from a nonprofit corporation. This arrangement is similar to authority financing in that a nonprofit corporation is created with the authority to issue revenue bonds. The bonds are secured by the lease agreement, and interest earned by investors is tax-exempt. At the end of the lease period, the facility is transferred to the local government. This method of financing reduces cost and permits construction of facilities to desired specifications by competitive bidding.[A-92]

Loans

In a few instances, bank loans have been used for financing local capital development programs. Generally this method is expensive due to high interest rates.

Existing State Mechanisms

Direct State financing of major solid waste disposal facilities is not presently practiced. State governments, however, could play a significant role in solid or hazardous waste management by creating public corporations or authorities for that purpose. As in the case of local authorities, State authorities are granted the power to issue revenue bonds with interest accrued through user charges. A major advantage of this approach is the potential for creation of regional solutions to problems. Creation of a nonprofit corporate body or a utility under State authority permits cost-effective solutions to interregional problems through realization of scale economies. For large scale and widespread waste management problems this approach is not only more efficient economically but is likely to be more workable politically.

Whether the management agency is set up as a nonprofit public corporation or as a State regulated utility, several advantages are apparent. Major cost savings are usually involved in issuing large packages of bonds. Per unit overhead costs necessary to prepare the issue are lower, and the involvement of the State generally creates more favorable market terms. If the agency or authority is set up as a public body, added capital financing advantages are obtained through the tax free provision on income from such bonds. In many cases creation of a waste disposal service utility will reduce disposal costs of industries with particularly difficult waste disposal problems requiring special equipment and processes. Such equipment would generally be too expensive for individual industries to purchase.

The one major disadvantage to State control of utilities or authorities is a loss of local autonomy. The nature of the waste disposal problem, its costs, and the method by which diverse viewpoints are incorporated in the decision process will determine the degree of political opposition this arrangement can be expected to face.

FEDERAL FINANCING

Federal financing of a National hazardous waste disposal system conceivably could be developed along many different lines. This could include complete Government operation, either subsidized by the public sector or operated as a revenue-generating system to cover complete costs. Another possibility would be Government financing and construction with provisions for leasing to the private sector. Again, this could be operated as a full-cost recovery setup or could be envisioned as a partial or complete subsidy to the private sector. Other means of direct Federal involvement in a hazardous wastes disposal system would include guaranteed loans and the regulatory policies which guide the private sector in its provision of hazardous wastes disposal services. Examples of Federal financing programs include the following.

United States Postal Service

The U. S. Postal Service is a Government-owned corporation operated on a self-supporting basis. It was created as an independent establishment of the Executive Branch by Section II of the Postal Reorganization Act of August 1970, and commenced operations in July of 1971. It is set up with a Board of Directors empowered to set rates and as a corporation with full control over postal revenues and expenditures. As such it is empowered to borrow from the public with an upper limit of $2 billion in bonds and debentures per year, up to a total of

$10 billion. To date it has $250 million in debt financing. During the transition period some subsidies have been required, but subsidization will be completely phased out by 1984. Its employees receive benefits similar to those of Civil Service, though they are not subject to the same system of raises and are empowered to negotiate for their own pay scales. The Board of Directors is appointed by the President on a staggered basis and this Board of Directors then selects the Postmaster General and his assistant.

National Railroad Passenger Corporation (Amtrak)

The National Railroad Passenger Corporation was created by the Rail Passenger Service Act of 1971. This is a corporation similar to the U. S. Postal Service with the express purpose of providing passenger services to selected areas of the United States on a profit basis. As originally envisioned, the public was to be offered a chance at ownership through convertible preferred stock issues paying 6 percent dividends. To date, no preferred stock has been issued because the corporation has shown a substantial loss and no market for its securities presently exists. Fiscal 1972 operating revenue was approximately $152 million while expenses of $306 million were incurred. These expenses include capital expenditures in terms of refurbishment of equipment as well as operating costs. The deficit is made up from a guaranteed Federal loan of over $100 million, a $40 million transfer, and a $300 million buy-out fee from railroads, as well as other Federal sources. Railroads which contribute to the operation are given options on electing a portion of the Board of Directors and receive stock for their portions of the financing.

Tennessee Valley Authority

The Tennessee Valley Authority was established as a corporation by Congress on May 18, 1933. TVA was created to develop and operate a program of resource conservation and development in the Tennessee Valley area thus inducing economic growth. The Authority operates a system of interrelated dams on the Tennessee River and its larger tributaries. The dams provide a variety of benefits, including flood protection, navigation, recreation, and, most important, production on electricity. According to the provisions of the TVA Act, the Authority is to promote the widest possible use of electricity and to assist in the Tennessee Valley area's regional economic development. As such, the power production is the only financially self-sufficient activity. TVA has the authority to issue bonds and, over the long run, under the interest criterion established, has been self-liquidating. It is in the process of repaying all initial Federal appropriations. On the other hand, the navigation, recreation, flood control, and related activities all receive annual appropriations from the Federal Government.

The Tennessee Valley Authority also operates a fertilizer research center in Muscle Shoals, Alabama, to promote the development and application of new fertilizer technologies and varieties. Some revenue is generated through the sale of relatively small amounts of fertilizer produced at this research laboratory. In general, no State contributions are involved in the overall TVA operations. On the other hand, there is State participation in local projects in which benefits accruing to local communities can be identified, such as water supply projects. For fiscal year 1971 Federal appropriations for the overall TVA operation were $56 million. Operating revenue from its electrical facilities totaled $642 million for fiscal '72. Total investment in TVA is several billion dollars.

Federal National Mortgage Association and Government National Mortgage Association

Since the great depression of the 1930s the Federal Government has attempted to both stimulate and stabilize housing and general construction activity through creation of secondary markets for mortgage securities which assure a reasonable degree of liquidity for such securities. Through various legislative acts, the Government has created secondary mortgage markets for Government-insured or guaranteed (FHA and GI) mortgages. The Federal National Mortgage Association represents the major attempt in this direction. In 1968 the FNMA was divided into two parts, the original Federal National Mortgage Association and the new Government National Mortgage Association.

Federal National Mortgage Association

After earlier attempts to create a secondary mortgage market in the 1930's had proved unsuccessful, the Reconstruction Finance Corporation was ordered to establish a national mortgage association under provisions of its enabling legislation, and the resulting organization became known as the Federal National Mortgage Association. Essentially it was organized as an emergency measure to provide liquidity for mortgage loans insured by the Government at high loan-to-value ratios and low rates of interest. It was also intended to provide money to stimulate new construction by purchasing FHA 100 percent guaranteed mortgage obligations. Under this arrangement only Government guaranteed and insured mortgages were eligible for purchase by FNMA. Emphasis was on new construction and current mortgage lending. By the middle 60's several apparent problems had materialized in the FNMA setup. As it actually operated, the majority of FNMA activities seemed to concentrate in those States where lending risks constrained the availability of private mortgage funds. By indirectly lending at below-market rates of interest in areas where risks would normally require a higher interest rate, the Federal Government constituted an implicit subsidy to the private sector in these areas.

Due to these problems and the need to create greater stability and availability of liquidity in the mortgage and housing market, the Federal National Mortgage Association was split into two distinct corporations under the Housing Act of 1968. The new Federal National Mortgage Association operates as a private corporation with privately held stock, but it is regulated by the Federal Government through the Department of Housing and Urban Development. The Housing Act provided a mechanism for a secondary market in conventional mortgages in order to broaden FNMA's secondary mortgage operations in the private sector. Under this arrangement both conventional and Government-backed loans are held by FNMA until amortized as scheduled. The purpose of this arrangement is to provide a supply of new money to the home industry above amounts normally generated through private market sources. Since FNMA is an investor-owned secondary market corporation, it must earn on its outstanding capital an overall return that provides a profitable return for its own capital investors.

Government National Mortgage Association

The GNMA retains many of the activities of the pre-1968 Federal National Mortgage Association. It is a Government agency and remains a part of the Department of Housing and Urban Development. As such it is a corporation without capital stock and is designed to handle special assistance management and related financial functions which were formerly part of the old FNMA. Under provisions of the 1970 Housing Act, GNMA and FNMA may work together for purchase of mortgages of lower income families. Under this arrangement, GNMA commits itself to low yield mortgages at their market value and then sells to the Federal National Mortgage Association at the going market rate. The GNMA absorbs the difference in price; the GNMA securities are backed by mortgage pools of the Federal Housing Administration and Veterans Administration which are secured by the credit of the United States Government.

PRIVATE SECTOR FINANCE

This section covers the preliminary identification and analysis completed on private sector financing mechanisms in the hazardous wastes disposal field. The report outlines the financing mechanisms available either presently or potentially to the private sector. Information collected on substantially all the financing mechanisms available to the private sector interest today is reported here.

The objective of this effort was to define and analyze the alternative mechanisms for financing a national system for hazardous wastes management. This objective has been developed in a succession of stages or phases:

- Identification of Financing Mechanisms
- Analysis of Financing Mechanisms
- Development of New Financing Mechanisms

Substantially all of the work has been completed on the first two phases and is presented here. In addition, a section on system configuration has been added due to its importance in relation to the second phase.

Identification of Financing Instruments

The various financial instruments for supplying funds for capital and operating expenditures derive from both the private and public sectors. These include the following:

Bonds

- Regular
- Industrial Revenue
- Pollution Control
- General Obligation
- Revenue
- Convertible

Equity Interests

- Common, Preferred, and Lettered Stock
- Full and Limited Partnerships

Internal Corporate Sources

- Retained Earnings

Public Sources

- User Taxes/Charges
- General Taxes (income, sales)
- Special Taxes (ad valorem, earmarked)
- Special Assessments

Loans

- Banks/Financial Intermediaries
- Insurance Company
- Subdivision, State, Federal

Leasing

- Long-term

Tax Credits

- Special Investment Credit

Variations in each instrument can be used separately or in combination with other instruments for financing a system. In some cases a combination may achieve the most economical financing. Furthermore, specific operating cost financing schemes may be changed from time to time allowing a degree of freedom which does not exist for capital cost financing. Each major category of financing instrument is discussed briefly below.

Bonds

This financing mechanism is a product of the market mechanism for obtaining capital resources. The two sources issuing bonds are private corporations and public organizations (municipalities, regional authorities, and the Federal Government).

Private corporate bond issues, (i.e., straight bonds) which have taxable yields as well as taxable capital gains, if any, are sold to the public through investment bankers. The investment banker together with the issuer jointly considers the intended use of the proceeds, the history of financial success of the issuing company, and relevant market factors such as prevailing interest rates in determing the size of the bond issue, its degree of risk, and its coupon rate.

Convertible bonds, also issued by private corporations, have many of the features of straight bonds. However, this security can be exchanged (or converted) into an equity position (to common or preferred stock) under conditions noted in the indenture defining the terms of conversion. Convertible bonds offer the investor the right to change from holding a debt security to holding an equity position in the corporation.

The four remaining bond types are issued by public bodies, such as school districts, authorities, counties, and other political subdivisions.

Industrial revenue bonds (IRBs) are issued by political subdivisions; pollution control bonds, a special type of IRB, are usually also issued by political subdivisions. These mechanisms offer potential sources of financing for a system of hazardous waste disposal facilities, other pollution-related financing needs (e.g., solid waste disposal facilities, industrial pollution control equipment, and various air and water pollution facilities for private companies or political subdivisions), and other facilities used by or for the public welfare.

The interest payable on each of the publicly issued bonds is exempt from Federal income taxes under existing statutes, regulations, and court decisions. In addition, depending upon the State regulations on issuing bonds from political subdivisions or authorities, the income (excluding capital gains) to the bondholder derived from selling the security may be exempt from State, county, and municipal taxes.

It should be noted that industrial revenue bond (IRB) financing is totally exempt from taxes on interest regardless of the use of funds for issues less than $5 million. For IRB financing in excess of this figure, restrictive covenants determine the use of funds to obtain tax-exempt status. There is no indication that capital gains on IRB or other bonds are tax-exempt by the Federal Government.

Industrial revenue bonds are used to finance industrial plants, equipment, or facilities. These assets in turn are sold or leased to a private corporation by the public body which issued the bonds. Lease payments must be sufficient to cover the interest and principal of the bond issue. Industrial revenue bonds are secured by the lease or sale agreement with the private corporation using the assets rather than the taxing power of the issuer; essentially, the corporation obtains long term capital generated through a tax-exempt security, thereby reducing the corporation's cost of capital. The political subdivision or authority issuing the IRB acts only as a conduit between bondholders and the private company. The credit rating of the corporation entering into the lease or sale agreement is the usual credit rating of the issued IRB; the political subdivision issuing the IRB is transparent for purposes of the bond credit rating. IRBs have no effect on the credit rating of their issuer or his debt capacity.

Pollution control bonds (PCBs) represent the result of a 1968 Treasury Department decision to limit the tax-exempt status of IRBs used to finance general industrial expansion to issues of less than $5 million. Issues greater than that amount would be tax-exempt only if the proceeds of the bond issue are used to provide certain exempt facilities, including air or water pollution control facilities. PCBs are special IRBs which may be issued in any amount and retain their tax-exempt status. In summary, tax-exempt IRBs may be issued:

(1) in any amount to finance pollution control or other exempt facilities or assets (these are called PCBs); or

(2) to finance any facilities or assets, provided that the $5 million limit is not exceeded.

General obligation and revenue bonds are tax-exempt issues used to provide financing for exempt persons as defined in Section 103(c) (3) of the Internal Revenue Code; exempt persons include governmental units and certain nonprofit organizations. The proceeds of these issues can be used for any purpose designated by the issuer. Typical examples of GO and revenue bond financing include construction of public auditoriums, hotels, parks, and certain office buildings. General obligation bonds provide for a guaranteed payment of principal and interest through the taxing power of the issuing political subdivision; revenue bond interest payments are not guaranteed by the issuer but are supported through the revenues generated by the projects financed by these bonds.

Equity Interests

The equity interests which are potential finance mechanisms include common, preferred, and lettered stock and partnership arrangements. The stock mechanism is typical of any private sector ownership in which the business risk is borne by the shareholder. Preferred stock, as the name implies, has privileges usually related to the order of payment of dividends or, in case of bankruptcy, in dissolution of the company's assets. Preferred stock is the most senior security in the equity class.

Common stockholders are the residual owners of the private enterprise after all other senior securities have been serviced. Common stock is more risky to hold than preferred stock and has the greatest potential for profit or loss of any of the typical financing mechanisms used to provide funds to a private corporation.

Another class of stock, lettered stock, is infrequently used to provide funds to a private corporation. This stock is usually employed in business situations which are highly risky and potentially very profitable for their owners. Often this stock has little liquidity (is not readily marketable).

Partnership arrangements to provide financing are of two principal varieties, full and limited partnerships. As their names imply, the risk and, consequently, the potential rewards for full partnership arrangements are greater than in limited partnerships. Full partnership financing arrangements carry with them unlimited liabilities if the business fails; that is, a full partner risks all his personal capital as well as that used in the business in which he holds a partnership interest. Conversely, limited partners usually risk only the amount of capital committed to the business. Limited partnership arrangements are often used as tax shelters by persons with high taxable incomes. Limited partnerships are sometimes used in conjunction with certain leasing arrangements to be discussed below.

The above equity interests relate only to the private or quasi-public sector, as in a Comsat-type corporation. No equity interests are available in municipalities, counties, regional authorities, and other political subdivisions which by their public nature cannot issue securities granting ownership rights.

Internal resources available to finance private corporation ventures are obtained from retained earnings, on earnings available after all expenses and deductions have been made from all sources of income, operating and nonoperating revenue streams. Retained earnings represent an accounting entry, not a pool of liquid assets. However, this resource can be used to finance corporate expansions into new or existing businesses.

Financing can also be obtained for the system through the taxing power of various political subdivisions. The four taxes examined can each generate funds for construction, operation, maintenance, and perpetual care of the system. User taxes/ charges represent a charge based on a prorated formula, usually by volume or weight of waste processed by the facility. This is a direct charge which forces the financial burden onto the waste generators. General tax revenues are also possible sources of financing. Using general tax revenues places the burden of financial responsibility upon all persons in the political subdivision imposing the general tax. Special taxes and assessments differ from general tax revenues in that they are clearly identifiable as to their amount and purpose. These may be imposed upon certain persons in the general population of the subdivision. Note that authority structures have no taxing power.

All tax sources are the province of the public sector; no private corporation or partnership can employ tax revenues directly. In the case of loans from a subdivision to the private sector, tax sources may be used indirectly, however. Loans from banks, insurance companies and other financial intermediaries may also be sources of funds to finance the system. It may also be feasible to obtain a combination of insurance and loans from a major insurance company or consortium of companies to reduce the effective interest rate on the loan.

Loans from banks may carry lower-than-market interest rates if a favorable IRS ruling is obtained to allow interest payments to the lending institution on the loan to be excluded from its taxable income. Lastly, loan instruments are generally intermediate term (5 to 10 years) financing mechanisms.

Leasing may also be used as a financing tool. Lease arrangements primarily supply capital assets without the need for large initial cash outlays, securities issues, or significant balance sheet changes. Leases supply working assets without impairing the corporate debt-equity ratio, which is used as a guideline in credit rating. However, leases must be reported (at least a footnote) in the corporation's balance sheet. If the public sector leases facilities, no voter approval is required. The public organizations reviewed which use leasing do so only as interim financing, for a period of months, until other financing such as budget allocations is found.

Ordinary lease arrangements are typically accompanied by higher interest costs but relatively little initial cash flow. In the case of leveraged leasing, a transfer of certain tax benefits from the lessee to a third-party financial institution (e.g., a bank) results in lower interest expense to the lessee. In leveraged leasing a third-party financial institution invests some fraction of the equipment/facilities cost, usually in the range of 20-40 percent; the remaining 60-80 percent is borrowed from long-term lending institutions. The equipment/facilities are then leased by the third-party interest to the lessee, who makes rental payments at least sufficient to cover the principal and interest on the long-term debt. This debt is secured by a lien on the equipment and an assignment of the rights of the third-party financial institution.

Lease terms generally range from 10 to 30 years; the terms of the lease must be less than the useful life of the leased assets to qualify as a true rather than financing lease. In the latter case the lessee would be treated as the asset owner for tax purposes. Usually the lessee will have the option to purchase the assets at lease expiration at its fair market value.

The key to leveraged leasing rests in the allocation of depreciation and investment credits to the third-party financing institution. The degree to which the lessor will effect interest savings for the lessee is realized only to the extent that the tax benefits shifted to the financial institution could not be used by the lessee if he had chosen to purchase or obtain a financing lease.

Variations on leveraged leasing are available. One variation is to obtain the long-term debt portion of the financing from an authority or political subdivision which issues tax-exempt IRBs or PCBs. Proceeds from the bond issue, together with a prepaid rent of 20 to 40 percent of the equipment/facilities cost supplied by an institutional investor, are then used by the authority/political subdivision to purchase the equipment facilities. The institutional investor obtains a financing lease from the authority/political subdivisions. The institutional investor then becomes the owner of the assets for tax purposes; in turn the institutional investor subleases the assets to a private corporation under a true lease. An income tax ruling would have to be obtained to determine if the sublease qualifies as a true lease; bond counsel opinion on the legality of a political subdivision entering into the transaction may also be required. As in the case of straight leveraged leasing, the interest savings to the private corporation are based on the grounds that the institutional investor can realize tax benefits that the company itself could not have used.

Other arrangements using limited partnerships to supply the 20 to 40 percent of the asset cost with either long-term loans or IRBs supplying the balance of the purchase cost are analogous to the above two examples. In this case the tax benefits accrue to the limited partners in much the same way as these benefits accrued to the financial institution in the above examples.

The private sector may be able to make use of tax benefits from investment tax credits and accelerated depreciation schedules to help finance the development and operation of a processing and disposal site system. In conjunction with these tax write-offs, guaranteed loans or bonds may become available to the private sector for additional financing sources. New legislation would be necessary to allow guarantees on loans or bonds for financing part or all of the system. Together these mechanisms may enable private corporations to more easily identify a potentially profitable business opportunity and enter this area as a new business.

ANALYSIS OF FINANCING MECHANISMS

The mechanisms discussed above will be reviewed on the basis of their practicality and degree of utility in providing funds for a national site system. This analysis attempts to identify the characteristics of the possible financing mechanisms and factors affecting them in relation to their capabilities for generating sufficient funds at reasonable cost. A principal concern in this analysis is acceptability of a mechanism to either the public and/or private sector interests which might employ it. In addition, incentives for developing new financing mechanisms will be discussed in this section.

Industrial Revenue/Pollution Control Bond Issues

Of the bonds available for financing the site system, PCBs have an advantage since a) they can be issued in any amount, b) they are tax-exempt for all but substantial users of the assets so financed, and c) they are financing vehicles acceptable to the investment community. A major consideration in issuing PCBs is the potential that this type of security will be phased out of existence if IRS rules unfavorably on their tax-exempt status as they did on IRBs in 1968. Consequently, plans to roll over debt using future issues of PCBs are speculative and may not be reasonable.

The interest cost on PCBs and IRBs is equal, generally 1 1/2 percent to 2 1/2 percent lower than the market interest rate on long-term funds; however, IRBs carry the $5 million limitation on unrestricted application of the proceeds of the issue. In cases in which an IRS ruling is required, the tax-exempt status of the issue must be within the guidelines established in Section 103(c) of the Internal Revenue Code. Cases which meet the established guidelines can use PCBs issued in any amount. It is possible that the system would qualify for tax-exempt status under IRC Section 103(c); an IRS ruling will be required to fully determine this issue.

A private corporation using PCBs may frequently be treated as the owner of the facility for Federal income tax purposes. This would entitle the company to take depreciation on the facility, the investment credit (if available), and to deduct a portion of the lease payments equivalent to the interest on the bonds. In addition, it has been possible for private corporations to use PCBs without restrictions on other forms of borrowing by the company. Further, these bonds are exempt from the registration requirements of the 1933 Securities Act and, in many States, from qualification under the Blue Sky laws. In States where the political subdivision is treated as the owner of the facilities, the private company may be entitled to a total or partial exemption from State and local taxes on real property or make reduced rental payments in lieu of these taxes. In some States, the private company may be exempt from sales taxes on materials and equipment used in constructing or acquiring the facility. Lastly, IRBs (or PCBs) are a less costly form of bond financing than straight or convertible bond financing.

General Obligation and Revenue Bonds

General obligation and revenue bonds are tax-exempt but less attractive financing mechanisms. GO bonds require a pledge that the principal and interest will be secured by the taxing power of the political subdivision. In addition, these bonds affect the borrowing capacity of a political subdivision since they reduce the subdivision's unallocated debt capacity. Revenue bonds carry the credit rating of the issuer but do not affect the unallocated debt capacity of the issuer. Revenue bonds do not require voter approval and are serviced only out of user charges.

Authority Financing

In offering public bonds, it is advisable to establish an authority for a number of reasons. First, deficit operations of an authority do not result in liens against the local government; next, the credit rating of an authority's bonds is independent of the political subdivision, including the authority; lastly, authority bonds have terms up to 40 years. Further, since the administration of an authority often outlasts the term of office of local officials, a degree of independence is maintained.

In conclusion, bonds, particularly PCBs, represent a viable and continuous mechanism to finance a site system. The degree of risk and the accompanying return are commensurate.

Equity Financing

Equity interests hold less promise as complete financing vehicles since they entail a far greater degree of risk by investors. It presently is not clear that there would be a market for stock in private companies seeking hazardous waste disposal business. Clearly, the worst case of any equity interest is the full partnership since this arrangement carries unlimited liability. In a business where the future risks cannot be reasonably assessed, full partnerships are extremely risky. Limited partnerships, on the other hand, offer potentially the best source of equity financing for the system since these investors will at least be able to obtain a tax shelter. The poorest equity financing mechanisms for this system are common and lettered stock since there is virtually no publicly available operating data on an operation of this nature. There is no protection of a guaranteed dividend payment which accompanies preferred stock if the company make sufficient profit to pay any dividends; consequently, the holder of common or lettered stock has no assurance that he will ever be able to recoup any of the investment.

Retained Earnings Financing

From the standpoint of a corporation, retained earnings financing should be a cheaper means of financing any corporate expansion. However, due to the magnitude of the required investment, it is extremely unlikely that any one company alone would be interested in developing a complete national system. Instead, in conjunction with a PCB issue, a corporation may be willing to establish a wholly-owned subsidiary holding a controlling interest in one or more processing and disposal sites. The nature of the entire system would have to be determined to elicit retained-earnings financing from the private sector. Various systems configurations will be discussed below to identify possibilities.

Tax Financing

Public taxing power is capable of generating sufficient funds to finance a national site system. However, it is unlikely that political subdivisions will readily assume this posture since hazardous waste disposal has no precedent for funding by local, county, or State government. Further, it is quite likely that these governmental units will argue that hazardous waste disposal is a national problem; as such they may argue the problem should be treated by the Federal Government. Since officials of political subdivisions are reluctant to increase the taxes of their electorate, it is unlikely that they will readily adopt the responsibility of financing the system's disposal sites through tax revenues. It is expected that some wastes processed at a facility will not be generated locally, which further removes the case for local tax financing from realistic consideration. However, the user tax appears to be a feasible mechanism for financing operations and maintenance.

Loans

The case for using loans to finance a national site system is weak, due to their high costs. In addition, since the financial community grants loans primarily for the intermediate term, an alternative means of refinancing would have to be planned from the start. However, an FNMA-type organization might either guarantee a loan or buy an issue from an authority or political subdivision and resell its own issue; this action, although not now a practice of FNMA, would present an innovative financing approach approximating a loan arrangement with a third party financing partner (i.e., the FNMA-type organization). Lastly, it is unclear whether the commercial banks would be interested in granting loans to finance the system (or some portion of it) without a form of Government guarantee or tax-exempt feature attached. consequently, for the above reasons, it is doubtful that a loan arrangement would be a realistic form for financing this system.

Lease Financing

Although true leasing is a high-cost way of financing, it may be possible to employ leverage leasing to the extent that the cost of capital would be reasonable or possibly even attractive. The problem with leverage leasing (and its modifications) is that IRS rulings are needed to determine their tax status for financing this system. However, leverage leasing does appear more feasible than loans, retained earnings, or public tax sources.

Tax Credits

Since tax benefits can only assist the private corporation in reducing the cost of developing the operating sites, they really do not have the capability of supplying a complete financing package. However, tax benefits accruing to private corporations interested in establishing sites may be sufficient to induce sources of private capital to finance the system.

DEVELOPMENT OF NEW FINANCING MECHANISMS

Most new and innovative financing mechanisms are combinations of previously existing mechanisms or features of the same rearranged to yield a better vehicle. Some of the newly formed mechanisms will require legislation to make them operational. The basic factors which are manipulated to form financing mechanisms for the system are tax exemptions and guarantees of interest or coupon payments.

As an example, a security which reasonably may supply financing for the system is an authority-issued bond with tax-exempt and coupon-guarantee status; this issue would incorporate the highest degree of security for the investor while requiring enabling legislation to attain the guarantee status. Presently the Department of Housing and Urban Development, through the Community Development Corporation, guarantees obligations of private developers of new communities. Under Title XI of the Merchant Marine Act of 1936 the U.S. Government guarantees payment of interest and unpaid principal. Furthermore, the payment of principal and interest on Washington Metropolitan Area Transit Authority bonds is guaranteed by the U.S. Government through the Department of Transportation pursuant to Public Law 92-349. Consequently, precedent for guarantees exists; however, these issues do not have tax-exempt status. An issue with both would be attractive to the investment community.

Variations on the use of guarantees with limited partnership interests, common stocks, or loans also present possible financing mechanisms. For example, to use tax-exempt IRBs in conjunction with tax-exempt loans from commercial banks would render residual financing attractive to speculators for equity positions since the potential for loss would be small while potential for gain might be very large. If equity positions are not offered, the portion of the financing supplied by tax-exempt IRBs may have to be increased in order to elicit response from commercial banks. In either case no enabling legislation would be required to accomplish this financing.

Financing the system in the holding company mode could entail tax exemptions on operations for a stated period to elicit private sector financing if public authority bonds are not available. The tax exemption on operations would then be equivalent to exchanging present outlays for future tax-free revenue streams. This arrangement may be very acceptable to a private corporation with extraordinary earnings now and a need to use these efficiently (i.e., to obtain tax shelters for their profits). Tax-exempt operating status would require enabling legislation.

Certainly the list of innovative financing mechanisms could be extended. However, the two basic factors, tax exemption and interest and principal guarantees, form the cornerstone for development of successful mechanisms to finance the system. The above are offered only as examples and are representative of a much larger number of possible combinations of financial media, some of which may require enabling legislation, others of which can be used in their present forms but in different combinations.

SYSTEM CONFIGURATIONS

To correctly determine a reasonable financing mechanism or set of mechanisms for funding development of the system, it is necessary to develop the configuration of that system. The system in broadest terms can be envisioned over a wider range, from a Government-owned and operated system to a free enterprise design, with other configurations falling between these two extremes.

The system itself will require a certification or licensing agency to see that safe and efficient operations are maintained. In addition, some provision must be made for transportation of wastes to the plant sites. Consequently, the site system can have many combinations and types of governmental and free enterprise involvement, from operation to transportation to perpetual care.

In one configuration the Government would totally own and operate the system. Bonds issued by political subdivisions or the Federal Government, Government loans and grants, as well as tax revenues could be used separately or in concert to fund this system. Legislation insuring that producers of waste would use the facilities could be passed, thereby providing a captive market for this service.

In free competition, private industry may be induced to establish plants across country by providing a ready market for the plant's service. To finance the system a combination of authority-issued PCBs together with some retained-earnings financing could provide sufficient impetus for the private sector to enter and actively pursue this business. Of course, a regulatory body would maintain appropriate standards for operation. Questions of rate structures may initially be left to the private sector with later imposition of a regulated rate structure once equilibrium pricing is attained.

A Government-owned, contractor-operated (GOCO) system patterned after the structure of the munitions industry could also be feasible. Financing would be supplied by the public sector; facilities would then be leased or contracted out to the private sector. Any number of working arrangements from fixed fee to leasing could form the basis of a joint Government-industry combination.

Another structure for the system could involve a utility concept with one holding company and many operating companies. In this fashion, if one operating company in a certain geographic region was profitable while another was unprofitable, the system as a whole might be able to better service the public need. This concept is analogous to a telephone company's structure. Questions on profit limits and rate structure would be resolved prior to issuing securities to finance such a system. It would be necessary to maintain monopolistic competition for the holding company structure to work effectively.

Many other alternative configurations could be developed which would directly affect the financing instruments employed, the regulatory nature of the system, the monopoly conditions established within the country, rate structures, forecasted market size and penetration, degree of enforcement of legislation prohibiting illegal dumping of wastes, and other conditions. These various system configurations must be considered before financing mechanisms can be selected on any set of criteria.

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